
SECTION 6.0 - ENVIRONMENTAL CONSEQUENCES

6.0 ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED PREFERRED AQUATIC DISPOSAL SITES

A detailed evaluation of the environmental and human resource impacts and benefits associated with the implementation of the two proposed preferred aquatic disposal sites (Figure 6-1) was undertaken, and is presented in this section. Where impacts or benefits associated with the disposal of UDM is common to both proposed preferred aquatic disposal sites, they are referred to as the proposed preferred aquatic disposal sites collectively. Where impacts or benefits associated with the disposal of UDM varies among the two proposed preferred aquatic disposal sites, the impact or benefit associated with each specific site is discussed. In addition, at the end of each subsection (e.g. 6.1 Sediments and Water Quality), a summary of the impacts that would occur/not occur as a result of the no action alternative are also presented.

Both of the proposed preferred aquatic disposal sites are CAD sites (Channel Inner and Popes Island North). A simplified sketch of CAD disposal types is shown in Figure 6-2. It is important to note that impacts could occur at several stages in the dredging and disposal process and, therefore, are evaluated as such in the ensuing sections. For CAD cells, there are potential impacts associated with the creation of the sites themselves, i.e. the excavation of sediment needed to create the disposal cells. Once the cells are created, then the impact of dredged material disposal into the cells is considered. Finally, the capping of the UDM with a sandy sediment, which would level the harbor bottom to its pre-existing depth, is evaluated. This final step is seen as the long-term effect of disposal, i.e. the effect of the presence of a patch of clean, sandy substrate in a harbor predominantly composed of soft silt and mud.

As discussed in Section 9.0 of this DEIR, the planned operation and management of the disposal site will have a bearing on the temporal and spatial aspects of impact. Currently, it is envisioned that either of the two disposal sites would be open for one dredging season within a five year window. The dredging window, as specified by DMF and DEP, is usually from late fall to spring and is designed to avoid the sensitive life stages of important fish and shellfish species. Therefore, excavation of the sites, placement of the UDM within the sites, and capping of the sites would likely occur within a period of less than six months. This period would be the time when *temporary* impacts could occur. After the cap is placed atop the UDM, then the potential impacts would be considered *long term*. The expected impacts of the project were evaluated based upon the following: site-specific information gathered during the DMMP process; previous studies of New Bedford/Fairhaven Harbor and the Buzzard's Bay region; studies done at other New England ports (e.g. Boston, Salem and Gloucester Harbors) and disposal sites, and laboratory studies of the effects of dredging and related activities. It is recognized that additional site-specific information is needed to complete the MEPA process and subsequent federal and state permitting.

The following site-specific efforts will be undertaken in support of continuing the MEPA and/or permitting processes:

- C Geotechnical borings to confirm depth to bedrock and determine side slope stability
- C Macrobenthic sampling and identification
- C Current meter measurements and basic water column chemistry
- C Dredging and disposal event modeling and hydrodynamic analysis
- C Underwater archaeological surveys
- C Physical and chemical analysis of surficial sediments

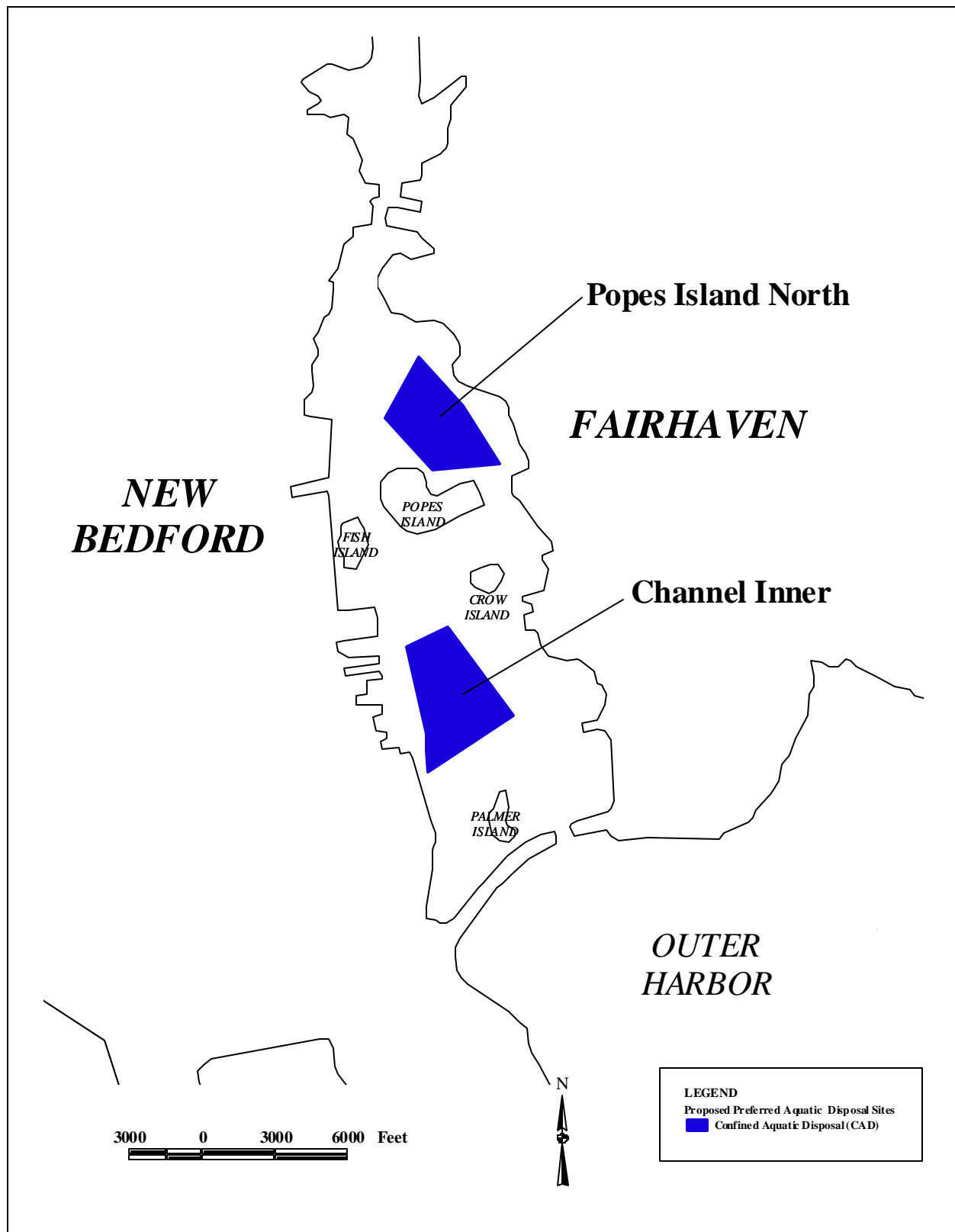


Figure 6-1: Proposed Preferred Disposal Sites

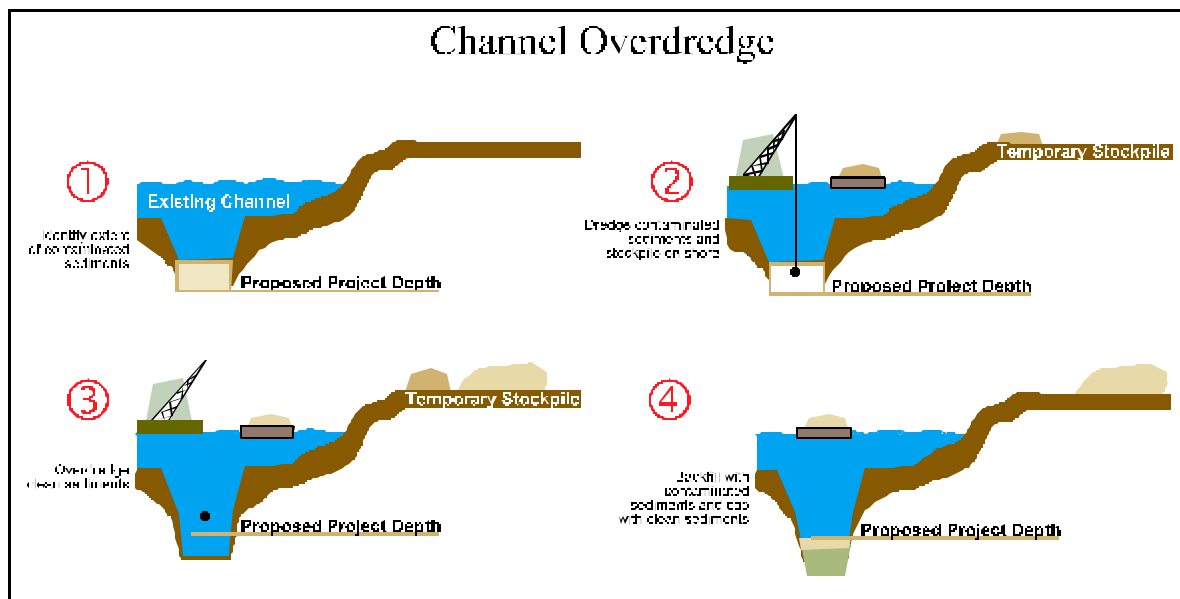


Figure 6-2: Schematic of Typical CAD Disposal Within an Existing Channel.

Depending on the actual volume of dredging to be conducted, either one or a combination of the two proposed preferred aquatic disposal sites could potentially be used to accommodate the actual volume of UDM dredged.

6.1 Sediments and Water Quality

6.1.1 Existing Sediments in the Vicinity of the Disposal Sites

Dredging and UDM disposal is intrinsically a high disturbance process with respect to existing sediments. The primary, potential repercussions of CAD excavation, UDM disposal, and subsequent capping of disposed sediments include the mortality of resident benthic organisms (especially sessile organisms), and the alteration of the existing sediment composition at the disposal site. The long-term sediment character is dependent upon the grain size of the final sediments at the surface cap relative to the pre-existing sediments, and the influence of re-colonizing benthic biota (Section 6.2.1). The expected type of sediment at the surface of the disposal sites is discussed further in this section.

The final character of the sediments overlying the disposal sites will be dependent upon the construction of the disposal sites. CAD sites are typically capped with a coarse-grained material (sand) because coarser grained sediment provides better resistance against resuspension, and stronger armoring capabilities. Because the existing sediment at the proposed preferred aquatic disposal sites is predominantly fine-grained, capping will alter the existing sediment type for a period of time. There is insufficient information to accurately predict the long term nature of the surficial sediments at the proposed disposal sites. However, rough estimates of shoaling rates in the federal channel areas of New Bedford/Fairhaven Harbor indicate that sedimentation occurs at a rate of approximately 0.5 in/year. This sedimentation rate is based upon the average amount of sediment accumulated in the harbor channels as derived from a comparison of historical bathymetric surveys (USACE, 1996). The specific shoaling rate

of the proposed preferred aquatic disposal sites is not known at this time, but will be evaluated as part of the final EIR.

Sedimentation rates in and around CADs will be increased if the final topography of the CAD cells is recessed below the existing bottom. Active sedimentation will likely fill the disposal site so that the surface sediments may eventually reflect the composition of the fine-grained sediment naturally deposited in the area. For example, CAD cells have been constructed at the bottom of the existing dredged navigation channel in the Mystic River (Boston Harbor) in the past few years. Consolidation of the sediments in the CAD cells resulted in a recessed topography that resulted in faster sedimentation at the top of the cells, as compared to the surrounding area (USACE, 1999). At the surface of a coarse-grained cap, it is unlikely that species that prefer unconsolidated fine-grained sediments will recolonize as quickly or thoroughly. Thus, some change in species composition could result through capping with sand. Nonetheless, sand-capped mounds in other projects have been recolonized successfully (SAIC, 1998), albeit by different species of organisms than those that had inhabited the previous fine-grained sediment.

The sediment profile sample stations within the proposed preferred aquatic disposal sites showed RPD values of -4 cm, suggesting moderate sediment aeration either through tidal flushing, bioturbation by Stage III organisms (subsurface deposit-feeders), or a combination of these two factors. The mean OSI was +4 in the vicinity of the Popes Island North site and the Channel Inner site. OSI values less than +6 typically indicate a disturbed benthos (ENSR, 2001). Excavation of these areas, disposal of UDM, and final capping will disrupt the sediment profiles and the organism-sediment relationships that have helped create them. The increased sedimentation rates into the recessed CAD cap may create a temporary situation in which accumulating organic sediments initially increase oxygen demand. This occurs since the former benthic invertebrate community has been eliminated through excavation, disposal, and capping and is no longer available to process the input of organic material entering the recessed CAD cap. As a result, an increase in heterotrophic bacteria could be expected, as the bacteria decomposes the organic matter consuming oxygen during the process. Therefore, CAD excavation, UDM disposal, and capping would be expected to result in a shallower RPD depth, and lower OSI values across the CAD cap.

Recolonization of the CAD caps will eventually re-oxygenate the sediment-water interface. Recolonization may begin as soon as a few days following the cessation of disturbance. However, data collected from the Boston Harbor Navigational Improvement Project (BHNIP, 2001) CAD sites and vicinity suggests that a significant improvement over present bottom habitat conditions (i.e., pre-disturbance) following UDM disposal and final capping may not be readily apparent, especially if other disturbance factors are responsible for sediment resuspension (e.g., physical bottom instability, prop wash, bow waves). In the BHNIP, the deepest RPD depth measured in one CAD cell was 1.08 cm and the OSI values ranged from +2 - +3, three years after final capping, compared to an RPD depth of 2.44 cm and an OSI range of +2 to +6 in an adjacent reference site, which was undisturbed by UDM management activities. However, sediment grain size at the surface of the recessed CAD cap had returned to a silt over clay composition, comparable to that of adjacent reference sites outside of the disturbance area. At another CAD site in the BHNIP, re-oxygenation of the sediment-water interface on the cap surface was delayed by cell wall sloughing and subsequent sediment resuspension. The high oxygen demand of the organic mud fraction was apparently responsible for creating anoxic conditions which formed following sloughing events (ENSR, 2001). Eventually, as sedimentation of the recessed CAD cap matches existing ambient sediment topography, and recolonization progresses to later successional stages, the benthos would return to pre-disturbance conditions. Recolonization of the CAD sites by benthic invertebrate biota and progression

through community successional stages is discussed in Section 6.2.1.

6.1.2 Sediment Transport/Circulation in the Vicinity of the Disposal Sites

The circulation of water in coastal embayments such as New Bedford/Fairhaven Harbor is influenced by a complex combination of forces produced by tidal fluctuations, wind, and density gradients. Factors such as wave height, geomorphology, and water-column stratification influence harbor current velocities, localized circulation patterns, and sediment transport. These factors are of particular concern in the siting and management of UDM disposal, since they will influence the long-term integrity of the cap material and the ability to isolate the disposed sediments from the aquatic environment at the CAD sites. The following discussion of potential impacts to sediment transport conditions from UDM disposal is based on analysis of historical hydrodynamic data collected from New Bedford/Fairhaven Harbor (see Section 5.3). A more accurate and complete understanding and prediction of impacts will be possible once site-specific circulation field studies of tidal currents and waves have been conducted as part of the Final EIR.

Hydrodynamic data collected within New Bedford/Fairhaven Harbor suggests that the areas in the vicinity of the preferred disposal sites are low energy, depositional areas. In depositional areas, fine-grained sediments accumulate and tend to be stable for long periods of time. Disposal sites located in these areas should effectively contain UDM in properly designed facilities. In contrast, boulders, rock outcrops, and coarse-grained sediments are typically detected in erosional or non-depositional areas. Erosional forces, due to a combined action of tidal currents and waves, may transport sediment away from disposal sites. Ensuring the confinement of sediments over time is difficult in turbulent environments, therefore locating disposal sites in low energy containment areas is of primary importance (Summerhayes, et al., 1985).

Given the level of information available, it is difficult to assess the potential site-specific impact of storm-induced circulation patterns within New Bedford/Fairhaven Harbor. Sites located in shallower regions may be more exposed to the effects of current scouring than those located at greater water depth which are relatively protected from meteorological conditions and surface wave-action. If storm-induced erosion does occur, the effects appear to be temporary as the sediment data from the proposed preferred aquatic disposal sites suggests a long-term depositional environment. In addition, the placement of a sand cap will reduce the potential for sediment resuspension over the CAD sites. Both sites are located in protected coastal embayments and are less likely to be exposed to significant storm-induced conditions because of the protection provided by surrounding land masses and the Hurricane Barrier.

Water column depth at the disposal sites may play an important role in determining localized current velocities. Bottom currents experience increasing friction as they approach the sediment boundary layer. Given this phenomena, CAD sites located at greater depth will be exposed to lower current velocities and less potential sediment resuspension forces than CAD sites at shallower depths. Coarser grained material also has the effect of greater frictional and gravitational forces holding the grains on the seabed. Thus a greater critical shear stress would be required to resuspend coarse-grain cap material than fine-grained silty sediments.

Hydrodynamic conditions may also be influenced by the construction of the containment cell created to disposal of UDM. In the case of Boston Harbor, an overdredged channel site was created which was moderately recessed from the surrounding channel sediments. The effect of this recessed pit was reduced

water column mixing with surrounding waters, and active sedimentation within the pits (USACE, 1999).

Navigational channels often experience some degree of reduced mixing via stratification due to temperature or salinity gradients. Bottom sediments within navigational channels can experience hypoxic or anoxic dissolved oxygen (DO) conditions due to the reduced vertical mixing and higher BOD from the accumulation of organic material. Reduced circulation may be beneficial from the standpoint of cap integrity (if required) since resuspension is less likely, but by the same effect, this localized condition may also contribute to reduced water quality (see next section). Site specific effects of currents on sediment transport in the vicinity of the proposed preferred alternatives will be reviewed for the FEIR.

6.1.3 Water Quality in the Vicinity of the Disposal Sites

6.1.3.1 Physical and Biological (Pathogenic) Water Quality Parameters

From prior overdredging projects, evidence suggests that the impact to water quality from UDM management is short-term (USACE, 1996; USACE, 2001). Handling of the material during excavation, disposal, and final capping may result in impact to physical water quality parameters such as a localized decrease in DO, pH, light penetration, and increase in TSS concentrations. Conditions typically return to ambient conditions within hours to days, depending on the amount and composition of the disposed material. For example, at the New London Disposal Site (NLDS), DO levels have been shown to return to pre-disposal concentrations from 15 minutes to 2 hours after disposal (U.S. Navy, 1979). NOAA (1977) reported that the DO content in the bottom waters at the NLDS dropped to about 48 percent of saturation and returned to ambient (84 percent) within 40 minutes. However, surface and middle waters were hardly affected. Therefore, it is likely that short-term negative impacts on water quality, particularly DO, would be greatest at the bottom of the water column.

Lee et al. (1977) reported that the greatest drop in DO in a Galveston, Texas disposal project was 1.7 mg/l, but at no time did the level drop below 5.0 mg/l. This is the concentration at which many marine organisms become stressed. Therefore, the short-term decrease of DO in the water column, at the scale and magnitude measured for other dredge projects, should not significantly impact mobile marine organisms. However, following excavation of the CAD pit, bottom water within the recessed CAD could become hypoxic or anoxic. Since most of the benthic community at this point would have been removed via excavation of the CAD, the temporary formation of hypoxic or anoxic CAD cell bottom waters is not considered to significantly impact marine organisms locally, in the area outside of the CAD site footprint.

Following disposal of UDM and upon final capping and closure of the CAD site, the CAD surface may remain slightly recessed to allow natural sedimentation processes to occur. Natural sedimentation would return the CAD surface sediment texture to pre-disturbance ambient texture. However, this recession may trap organic particles causing high bacterial decomposition and resultant decomposition, a process which consumes oxygen. Hypoxic conditions may persist in the area of these recessed CAD caps until bioturbation by the benthic invertebrate community and tidal flushing restores dissolved oxygen to pre-disturbance conditions. Hypoxic conditions would first favor re-colonization by organisms which have adapted to low oxygen environments. In extreme situations, these areas could remain azoic for some time, as re-colonization is delayed by anoxia (Section 6.2.1).

Total suspended solids may increase dramatically due to fine material in the water column. Material from a plume may extend short distances from the disposal site. A reduction in DO is typical as common constituents of sediments are oxidized and organic material is metabolized by microbial activity at the sediment-water interface. In addition, high, suspended, solid concentrations have the effect of attenuating ambient light at shallower depths. Therefore, the turbidity plumes produced by UDM excavation, CAD site excavation, UDM disposal, and subsequent capping may impact local primary productivity by rapidly decreasing diatom production with depth (Gallagher and Keay, 1998). Rapid mortality of ambient diatom populations may result in a measurable increase in oxygen demand, as heterotrophic bacteria begin to decompose the dead diatoms consuming oxygen in the process.

Water quality was extensively monitored in Boston Harbor during both dredging and disposal activities associated with the Boston Harbor Navigation Improvement Project (BHNIP) and Berth Dredging Project in Boston, Massachusetts (ENSR, 1997). Monitoring results collected from the BHNIP showed that the suspended sediment plume was limited to an area within 300 feet of the dredging and disposal activity. In New Bedford/Fairhaven Harbor, the scale and magnitude of this impact is small in relation to the area of the Lower Harbor environment where the CAD sites are located. For instance, a three hundred foot turbidity plume that has formed around a release point within the CAD site would impact a fraction (approximately <20%) of the CAD site area.

During the BHNIP, no increases in TSS were measured at the reference area 1,000 feet from the dredge. Although, short-term spikes were noted during passage of larger working vessels such as tugboats, tankers and bulk carriers. There were no apparent differences in DO between the monitoring stations and the reference areas. All of the contaminants measured were below chronic aquatic toxicity levels except for mercury, which measured above chronic but below acute aquatic toxicity values during a limited number of monitoring events. Bioassay data also suggested there was no difference in impacts between the area dredged and a reference area.

The final results from Phase 1 of the BHNIP showed that the project met the Water Quality Certification compliance standards during the operations, and data collected during Phase 2 of the monitoring has suggested similar results (S. Wolfe, personal communication).

There has been no dredging/disposal water quality monitoring in New Bedford/Fairhaven Harbor associated with the DMMP to date. In addition, there is currently insufficient oceanographic data to predict water TSS effects. As a result, the evidence from Boston Harbor (Figure 6-3) monitoring was used to estimate short-term impacts to water quality and aquatic resources in New Bedford/Fairhaven Harbor. Figure 6-4 illustrates the predicted 300-foot area of turbidity, from a hypothetical release point, as applied to the proposed preferred aquatic disposal sites. Within this 300-foot plume, measurable yet temporary decreases in DO could occur. Turbidity would increase significantly but would return quickly to pre-disposal conditions.

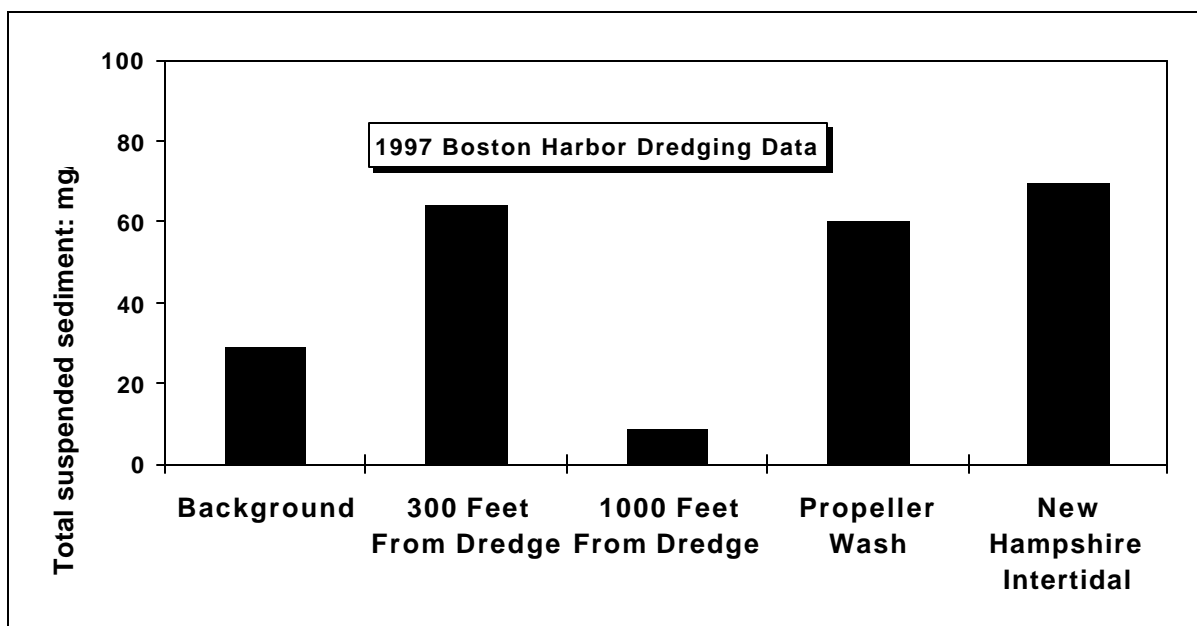


Figure 6-3: Total Suspended Sediment Measurements from Boston Harbor Dredging Operations.

During disposal of the UDM at the CAD site, sediment contaminants could be released into the water column, causing a temporary increase in water column pollutant concentrations (Section 6.1.3.2). However, this short term impact would be off-set by the long term benefit of eliminating a direct pathway of contaminants into the food chain. This is accomplished through reduction of exposure of benthic invertebrates to unconfined contaminated sediments. Contaminated sediments left in place is a source of exposure to benthic marine invertebrates and demersal finfish species via direct exposure and via ingestion of contaminated sediment, pore water and prey. Bioturbation can result in the mobilization or deposition of higher concentrations of contaminants than what may occur beneath the sediment surface (Aller and Yingst, 1978). To address site specific short term water quality impacts, additional site-specific studies, including oceanographic field studies to support water quality monitoring, will be done at a later date. Results of these studies will be presented in the FEIR.

A concern relative to long-term impacts to water quality was raised during the BHNIP. To ensure acceptable water quality, successful capping needs to be employed. Successful capping (defined as the placement of a discrete layer of three feet of sand over the entire surface of the cell) initially proved more difficult than first anticipated during the BHNIP. Although, most of the CAD cell was covered with a highly variable thickness of sand, the southern end had little or no cap material (USACE, 1999). Initial modeling suggested that tidal currents would influence the positioning of disposal barges to compensate for the anticipated transport of released capping material downcurrent. However, it was discovered during the monitoring phase of the project that the dredged material dumped from the barges fell directly to the bottom (USACE, 1999), accounting for the minimal cap material placement at the southern end of the cell. Therefore, preliminary estimates of sand transport due to prevailing currents were overestimated.

It was also determined that density differences between sand and fluidized UDM may have resulted in a mixing of sand cap material and UDM. This mixing phenomena was mitigated during Phase 2 of the project by allowing more time for UDM consolidation. Sediment that slumped from weakened cell walls may have contributed some of the fine-grained/coarse-grained mixture. Other construction measures, as recommended in USACE (1999), were employed during Phase 2. The result was a successful capping of UDM that satisfied DEP's water quality concerns (see DEP June 13, 2000 letter to USACE in Appendix B).

The BHNIP demonstrated the need for operational control during capping in order to ensure an even distribution of capping material over the CAD site, which includes the incorporation of real-time position tracking during sand placement. Similar operational control during capping would be enacted at the New Bedford/Fairhaven Harbor to ensure that a successful capping operation is conducted and short- and long-term adverse water quality impacts are avoided or minimized. For instance, the use of operational controls during capping (e.g., moving the scows around the cells while capping) and incorporation of real-time position tracking during sand placement would avoid errant capping efforts which could result in an uneven spatial coverage and variable cap thickness similar to the situation that occurred in the BHNIP. Deployment of one or more of the variety of monitoring strategies (e.g., single- and multi-beam bathymetry, sub-bottom profiling, sidescan sonar, coring, video, cone penetrometer) would be required to confirm cap coverage and thickness in order to avoid discrepancies in real-time versus model-predicted cap deposition and coverage.

The long-term impacts to water quality associated with UDM management would be avoided. By constructing CAD cells, basin bathymetry is not impacted because the final cap elevation is designed to match existing sediment elevations. Creating a recessed sand cap rather than an elevated mound would encourage sediment deposition rather than erosion. Avoiding creation of a raised sediment cap would prevent alterations of currents and flow regime, thereby, preventing erosion of the sand cap and exposure of the underlying contaminated sediments to the overlying water column. Long-term nutrient enrichment (a potential source of eutrophication to surface waters) would be avoided by using nutrient poor sand for the CAD cap. The nutrient concentrations of the sand cap could be verified by analytical testing of samples collected from the sand at the source. Impacts to water quality by total coliform and other microbial pathogens would not be considered a long-term impact because the Lower Harbor CAD sites lie in areas that are already closed to direct shellfish harvesting (i.e., without depuration) due to elevated coliform concentrations. Pathogens, alone (i.e., without accompanying sediment), are rapidly assimilated or neutralized by the estuarine system. Aside from potential human health impacts, pathogens typically pose little impact to the biota of the system (Wilson, 1988). Human health impacts would be avoided or minimized by the existing ban on finfishing and shellfish harvest in the harbor and the posted health advisories.

The technical specifications of the BHNIP have been compiled in Section 8.0 of this document. CAD Best Management Practices (BMPs), measures employed to reduce negative impacts, and a sample Water Quality Certification have been included to establish an operational framework and guidelines to ensure the DMMP proceeds in an environmentally sound fashion (Appendices L and M).

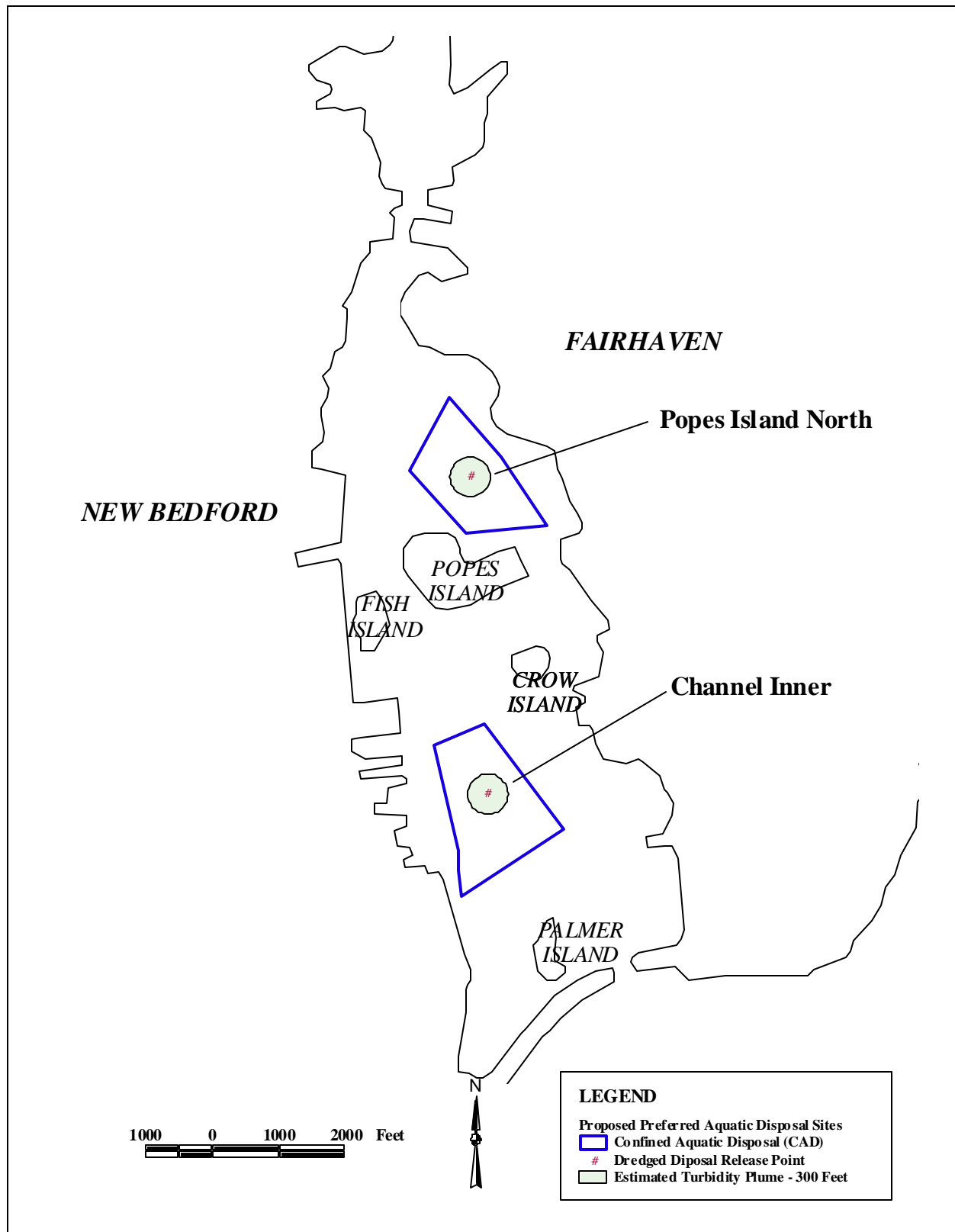


Figure 6-4: Estimated Turbidity Plume in Vicinity of Proposed Preferred CAD Sites

6.1.3.2 Pollutant Transport Modeling

A series of preliminary pollutant transport and fate simulations have been performed to estimate the water quality impacts in the water column from the proposed DMMP disposal operations for the New Bedford/Fairhaven Harbor (Appendix K). WQMAP (a proprietary model) was used to estimate the water column concentrations of pollutants of interest: various metals (mercury, lead, cadmium, arsenic, chromium, copper, nickel, zinc), polychlorinated biphenyls (PCBs), and total petroleum hydrocarbons (TPH). The model simulated the fate and transport of the disposal materials at the proposed Popes Island North and Channel Inner CAD sites. Two different disposal release scenarios were set up and run. The instantaneous release simulated acute conditions and the continuous release simulated chronic conditions.

None of the constituents were found to exceed the USEPA water quality criteria under the tested scenarios with one exception. The concentration of copper at the time of instantaneous release was 20 (Channel Inner) to 33 times (Popes Island North) greater than the acute criteria. However, the concentrations decreased with time and quickly fell below the limit. With a continuous release, the pollutant levels increased with time. None of the constituents reached the chronic water quality limit, except copper. At the 29th simulation day, the copper concentration was almost four times the limit at the Popes Island North site release. The pollutant level at the same day was predicted to be three to five times smaller for the Channel Inner site release.

The size and strength of modeled pollutant plume varied depending on the release location. The same amount of released material at the Channel Inner site resulted in smaller concentrations in the water column than at the other site. The reason was that larger currents were calculated by the hydrodynamic modeling (BFHYDRO) component of the analysis at the Channel Inner site than at the Popes Island North site. The pollutant plume also varied with time. For an instantaneous release, the plume decreased in size and strength. The location of the maximum concentration changed in space. On the other hand, for a continuous release the size and intensity of the plume gradually increased. The plume varied at time scales of semi-diurnal tides. The maximum concentration was always observed at the release site.

The water quality impact results presented in the model are based on the sediment chemical measurements from a site north of Fish Island (FI-A). FI-A data indicated the highest pollutant concentrations and was chosen as a conservative estimate. The FI-A site was chosen, as it represented the most polluted site of the 16 sites sampled as part of the DMMP, providing an overall conservative estimate of pollutant loading (Table 6-1).

The water quality impacts for mercury, cadmium, arsenic, nickel and PCBs constituents were estimated by scaling the simulation results from the FI-A site measurements. The loading rate is proportional to the elutriate concentration. The pollutant simulation is two-dimensional and only non-linear process involved in the simulation is the diffusive term that is proportional to the second order derivative of a mass. However, the temporal scale for the diffusivity is much longer than the mass advection by the ambient current. Therefore, a simple linear scaling is reasonable.

The initial concentration for mercury based on the maximum elutriate concentration of 1.34 µg/L, for example, is 0.26 µg/L at the Popes Island North site and 0.16 µg/L at the Inner Harbor site. These values are still below the acute criteria of 1.8 µg/L. The other pollutant concentrations are estimated in a similar manner and are far below either the acute or chronic water quality limits (Tables 6-2 and 6-3).

Table 6-1: Comparison of Maximum Elutriate Concentrations (µg/L) at the FI-A Site

Constituent	FI-A	Maximum/station
Mercury	0.72	1.34/LH-6
Lead	162.00*	
Cadmium	5.50	5.81/LHC
Arsenic	6.66	9.19/LHA
Chromium	335.27*	
Copper	866.02*	
Nickel	28.60	29.17/LHC
Zinc	444.38*	
PCBs	0.0276	0.0734/FI-B
TPH	3795.00*	

Note: Numbers with stars represent that the FI-A site has the largest concentration among the measurements at all 16 stations.

Table 6-2: Initial Concentration (µg/L) at each CAD Site Estimated by a Scaling

Constituent	Popes Island North CAD	Channel Inner CAD	Acute Water Quality Criteria
Mercury	0.26	0.16	1.8
Cadmium	1.06	0.65	42
Arsenic	1.67	1.02	69
Nickel	5.29	3.22	74
PCBs	0.03	0.02	

Note: The acute criterion for PCBs is not available.

Table 6-3: Maximum Water Column Concentration (µg/L) at 29th Simulation Day

Constituent	Popes Island North CAD	Channel Inner CAD	Chronic Water Quality Criteria
Mercury	0.02	0.006	0.94
Cadmium	0.08	0.03	9.3
Arsenic	0.12	0.04	36
Nickel	0.39	0.13	8.2
PCBs	0.00	0.00	0.03

Note: Estimated by a scaling

The size and strength of modeled pollutant plume varied with the location of release. With a release at the Channel Inner CAD site, the simulation resulted in smaller concentration in water column than at the other site. This may be due to the fact that the larger currents exist at the Channel Inner site than north of Popes Island. The plume also varied with time. For an instantaneous release, the plume quickly decreased not only in size but also in strength. On the other hand, the size and strength of the plume for a continuous release increased gradually at a large time scale and varied at a scale of the semi-diurnal tide.

Figures 6-5 through 6-8 graphically illustrate some of the WQMAP model output for New Bedford/Fairhaven Inner Harbor for selected parameters. The graphic examples show results of both an instantaneous (short-term) and a continuous release (long-term) of harbor UDM. Short-term model results for six and twelve hours from a release for mercury concentrations are shown in Figures 6-5 and 6-6. Long-term model results for a continuous release at twenty-nine days are shown in Figure 6-7 and 6-8 for ebb and flood tides. For more detail on WQMAP preliminary modeling please see Appendix K.

The fate and transport of the pollutant component simulated in this work is based on a hypothetical loading of 3,000 cy of dredged material per day. In the FEIR, loading will be refined and scaled based upon site specific data and conditions to obtain a more accurate estimate of pollutant concentrations, specifically copper.

6.1.3.3 Establishment of a Mixing Zone

DEP is charged protecting the public health and enhancing the quality and value of the water resources of the Commonwealth under the Clean Water Act. The objective is the restoration and maintenance of the chemical, physical, and biological integrity of the Nation's waters. To meet these requirements the Department has adopted the Massachusetts Surface Water Quality Standards which designate the most sensitive uses for which the various waters of the Commonwealth shall be enhanced, maintained and protected. The standards prescribe the minimum water quality criteria required to sustain the designated uses and contain regulations necessary to achieve the designated uses and maintain existing water quality including, where appropriate, the prohibition of discharges.

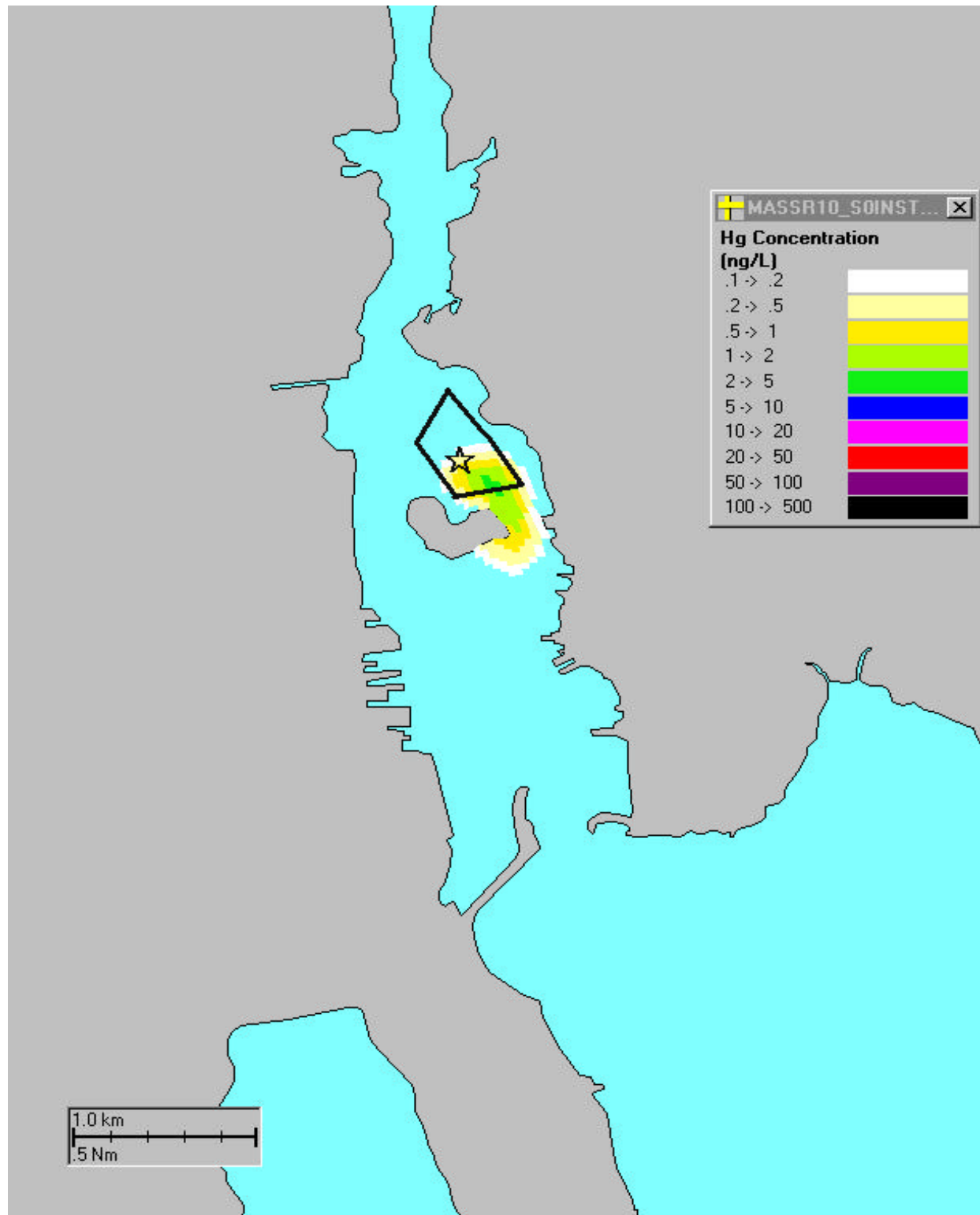


Figure 6-5: Six-Hour Modeled Mercury (Hg) Concentration at Popes Island North CAD

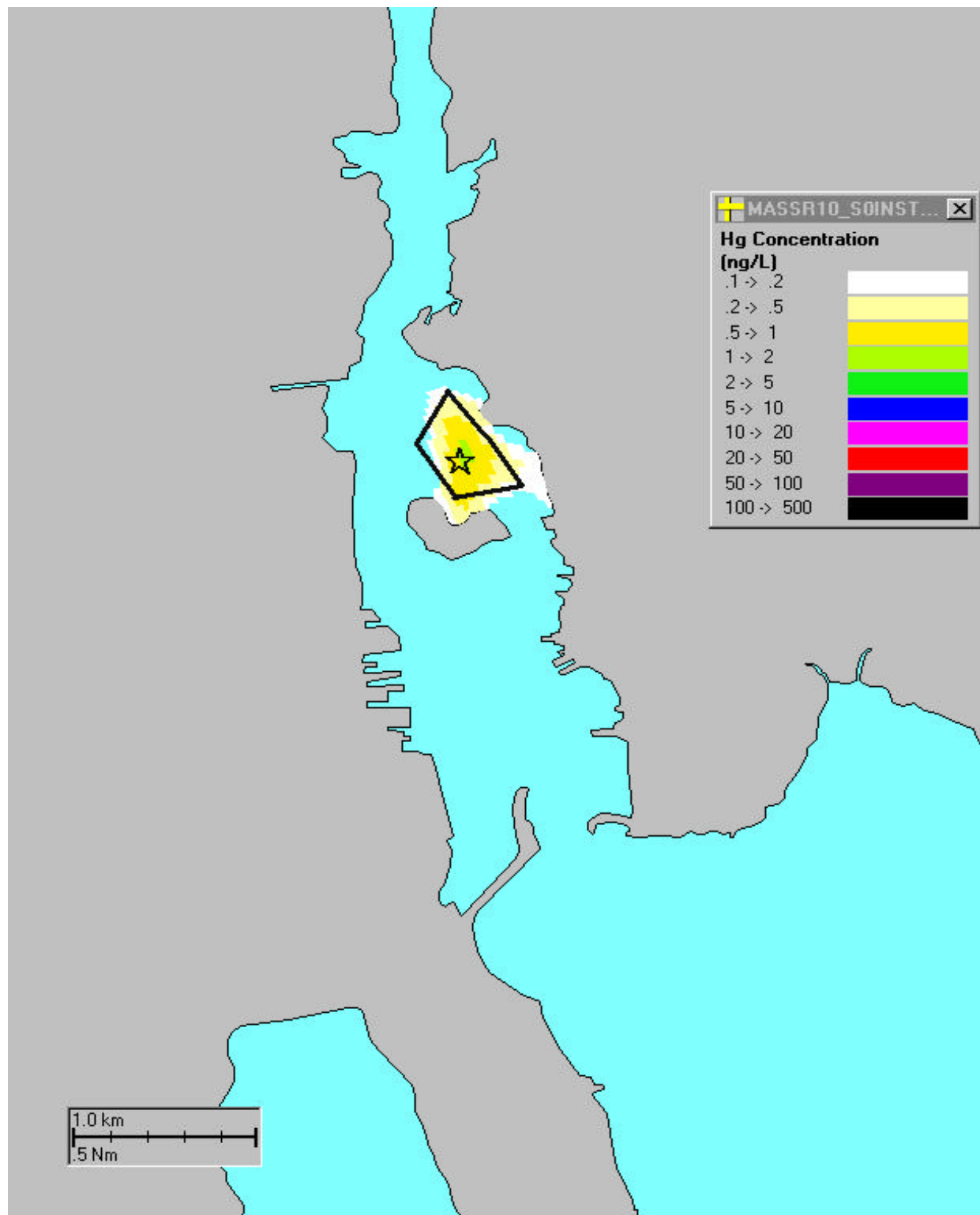


Figure 6-6: Twelve- Hour Modeled Mercury (Hg) Concentration at Popes Island North CAD

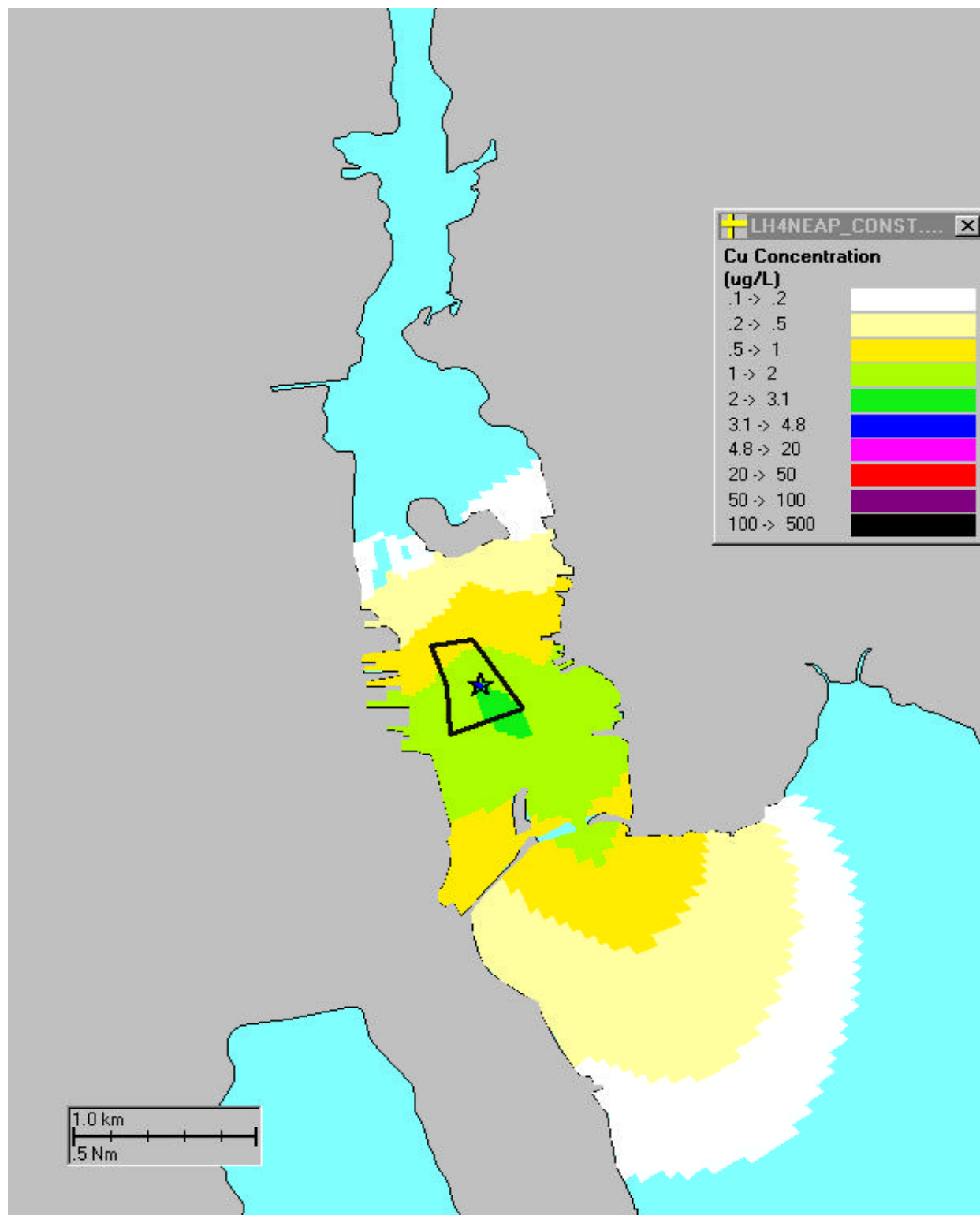


Figure 6-7: Twenty-Nine Day Continuous Modeled Copper (Cu) Release at Channel Inner CAD (Ebb Tide)

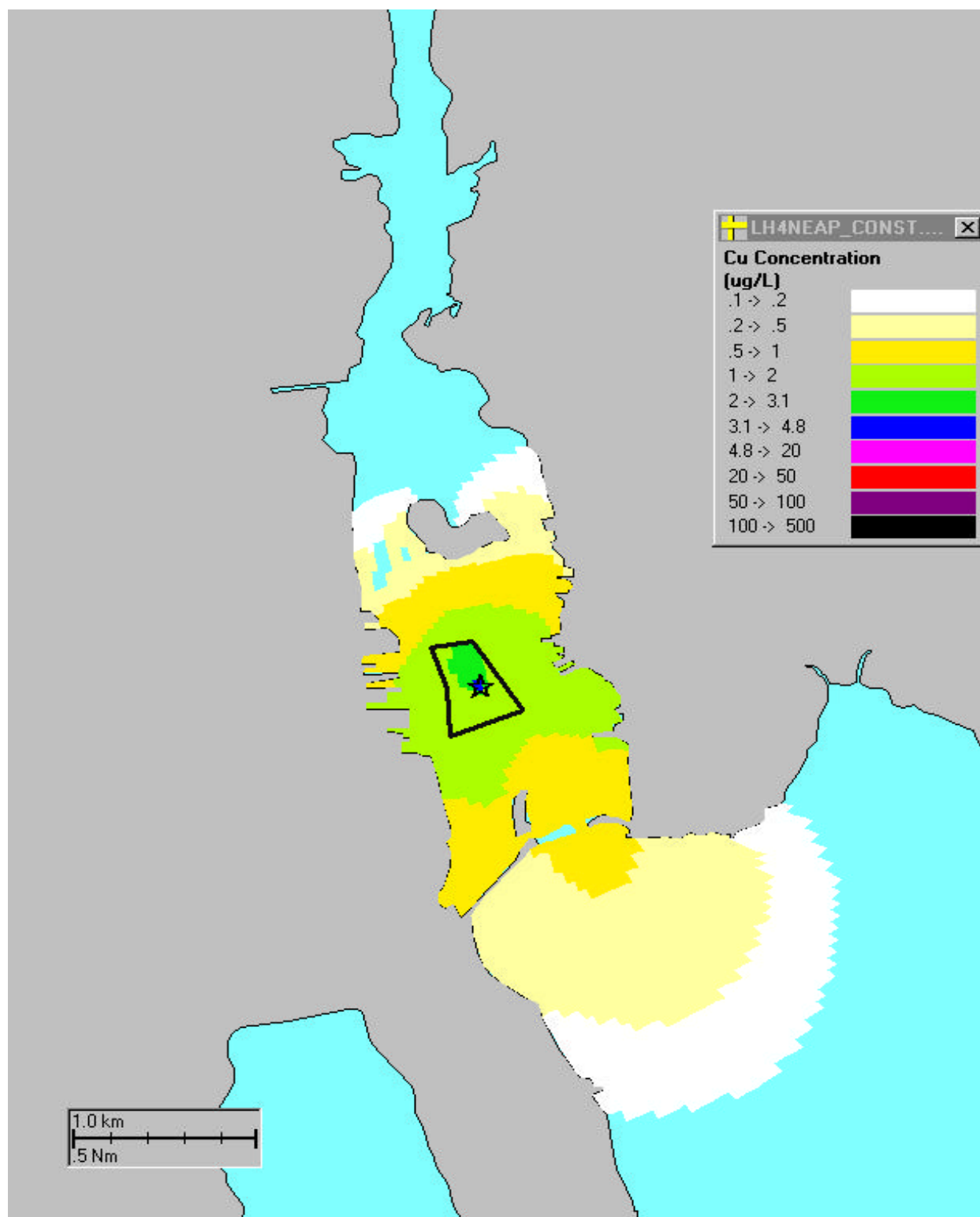


Figure 6-8: Twenty-Nine Day Continuous Modeled Copper (Cu) Release at Channel Inner CAD (Flood Tide)

In applying these standards the DEP may recognize a limited area or volume of a water body as a mixing zone for the initial dilution of a discharge. Waters within a mixing zone may fail to meet specific water quality criteria provided; the location, design and operation of the discharge shall minimize impacts on aquatic life and other beneficial uses, does not interfere with the migration or free movement of fish or other aquatic life, provides safe and adequate passage for swimming and drifting organisms with no deleterious effects on their populations and does not create nuisance conditions, accumulate pollutants in sediments or biota in toxic amounts or otherwise diminish the existing or designated uses of the segment disproportionately (314 CMR 4.03(2) a-c).

The use of either proposed preferred alternative sites would involve the disposal of more than 5,000 cubic yards of dredged material requiring a major dredge project certification (BRP WW 07) from DEP, Division of Wetlands and Waterways. The application will require a description of the proposed activity, detailed plan view and section, sediment analysis, and description of the characteristics of the proposed disposal site. The DEP may then put conditions on the dredging and disposal process designed to ensure compliance with water quality standards. A key method used to meet the standards is the establishment of a mixing zone, recognizing a limited area or volume of a waterbody as a zone for the initial dilution of a discharge. The limits of the mixing zone will be determined during the permitting process. With the establishment of a mixing no long-term detrimental water quality impacts would be expected.

6.1.4 No Action

If the proposed preferred aquatic disposal sites and vicinity were not to be used for disposal, existing water quality and sediment transport conditions at and near the site would remain unchanged.

6.2 Benthos

6.2.1 Benthic Invertebrates

Benthic invertebrate data, which are site-specific to the proposed preferred aquatic disposal sites, were obtained by the REMOTS® sediment-penetrating camera. This information is used to augment the discussion of environmental consequences to benthic organisms, which is based on various studies of how disturbances impact benthic invertebrate biota in the northeastern United States (Kaplan et al., 1975; McCall, 1977; Pearson and Rosenberg, 1978; Rhoads and Germano, 1982; Rhoads and Germano, 1986). The REMOTS® stations within the proposed preferred aquatic disposal sites in New Bedford/Fairhaven Harbor are as follows: Station 136 was located within the Channel Inner site, and Stations 142 and 143 were located within the vicinity of the Popes Island North site (Figure 6-9). The OSI (See Section 5.3.2.2) for these proposed preferred aquatic disposal sites indicates moderate overall benthic habitat quality at the Channel Inner site (Figure 6-9). The OSI values at the Popes Island North site were relatively high (>6) indicating good benthic habitat quality. The REMOTS® data provided for Pope's Island North represent a best case scenario, since deeper waters within the center of the CAD site may yield lower OSI values due to an expected decrease in benthic invertebrate abundance with depth (Gallagher and Grassle, 1989).

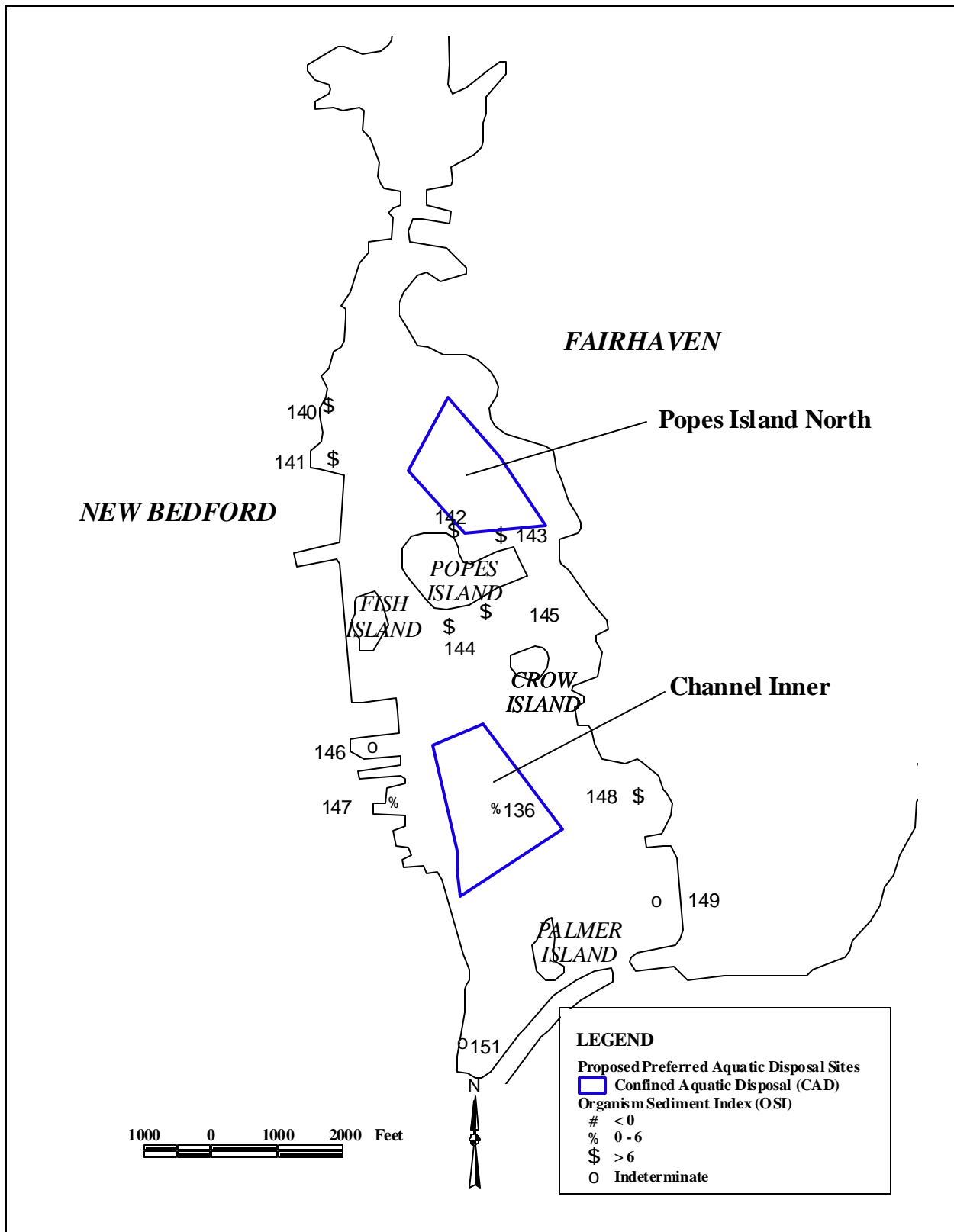


Figure 6-9: OSI Values for the Proposed Preferred Sites

Direct impacts to the benthic habitats and their organisms would occur as a result of the disposal site cell excavation, disposal of UDM and placement of capping material. All these events are expected to result in temporary and reversible impacts to the benthos at the proposed preferred aquatic disposal sites. Excavation of the CAD sites would result in mortality for many of the organisms residing on the bottom. Many of the larger, more mobile benthic megainvertebrates, such as crabs, would be able to flee the disturbed area. Following cell excavation, colonization of the substrate along the cell walls and bottom is expected via larval recruitment and emigration of benthic organisms from the surrounding area (Santos and Simon, 1980). However, the rate of recolonization is difficult to estimate because little effort has been made to study the recolonization of subaqueous pits. It is reasonable to assume that some recolonization of the CAD site following capping would occur. However, the type and abundance of benthos would depend on both abiotic and biotic factors as discussed by Gallagher and Keay (1998). Abiotic factors include physical substrate conditions, water temperature, dissolved oxygen content, and salinity. Biotic factors include succession, recruitment, competition, and biogeography.

As UDM is placed within the excavated pits, direct impact to the benthos would likely occur. Sessile marine invertebrates are not expected to survive burial. Some motile marine organisms would be buried and unable to survive, while others such as burrowing specialists, may survive. Vertical migration of motile benthic invertebrates (particularly crustaceans, polychaetes and molluscs), following burial has been demonstrated by Maurer et al., (1982a,b), and Nichols et al. (1978). These studies showed that burrowing organisms can survive repeated burial events by vertically migrating to the sediment surface. Survival rates depended primarily on burial depth. For example, in the Nichols et al. (1978) study, organisms were able to burrow upwards through 28 cm (11 in). However, it is reasonable to assume that repeated burial would weaken most benthic, motile organisms, resulting in direct or indirect (e.g., easier predation) mortality, since most disposal events would result in greater than 28 cm (11 in) deposition of UDM. In fact, the target thickness of capping materials may range from 30 to 90 cm (one to three feet).

Both the excavation and disposal events are likely to result in adverse impacts to pioneering benthic invertebrates. This is due to constant perturbation of the substrate by continuous dredged material disposal discharges. However, as discussed below, these impacts would be temporary. The long-term effect of having CAD cells in New Bedford/Fairhaven Harbor on the benthos is more important. The clean sand cap of the CAD cells would provide new substrate for recolonization by benthic invertebrate organisms and would prevent exposure of the benthos to contaminated sediments, resulting in a long-term benefit. The recolonization of the clean CAD cap would likely progress in successive stages, with dominant species varying over time. Although exact community assemblages are hard to predict to species level, the life history attributes and functional organism-sediment relationships are typically predictable. A typical recolonization scenario of the sand cap is discussed below based largely on recolonization studies described by Pearson and Rosenberg, (1978); Rhoads et al., (1978); and Rhoads and Germano (1982). There would be a change in substrate texture and conditions as a result of the placement of the sand cap atop the UDM. As suggested by the Boston Harbor CAD cell project, the cap would consist of primarily sand. However some silt may be introduced into the cap from slumping of the excavation walls and/or from active sedimentation occurring within the harbor (USACE, 1999). The result would be a primarily coarse-grained substrate with a small fraction of silt/clay. Typically, the surface of the cap would lie at an elevation below that of the surrounding sediment surface in order to allow natural sedimentation to occur within the recess of the CAD site, thereby replicating the surrounding sediment texture.

The specific nature of the benthic recovery process would largely depend on the timing of the disposal

operation, local habitat characteristics, and which species exist in the surrounding areas to form source populations for recolonization. Typically, the first colonizing species to arrive to a recently disturbed area are “opportunistic” (Stage I) tubicolous polychaetes or oligochaetes. The spionid polychaetes (*Streblospio benedicti*, *Polydora ligni*) and the various capitellid polychaetes (*Capitella* spp.) are typical pioneers species that could be expected to recolonize the sand cap within days of final capping (McCall, 1977). The spionid polychaete (*Streblospio benedicti*) is most likely to be the first to appear since it is the most abundant polychaete found in both the Upper and Lower Harbors (USEPA, 1996b).

Various meiofauna may also dominate (especially free-living nematodes) because they may be extremely abundant within the sediments of the region (Weiss, 1995). Refer to Wieser (1960) for a quantitative study of the meiofauna in the benthic communities of Buzzard’s Bay. Regardless of total macrobenthic densities during the initial stages of recolonization would likely be high and species diversity low (Grassle and Grassle, 1974; Kaplan et al., 1975; McCall, 1977; Zajac and Whitlatch, 1982; Jones, 1986). This situation may act to enhance the food supply of bottom feeding finfish species such as winter flounder (Rhoads et al., 1978).

The pioneer species occupy the sediment-water interface. Since colonization begins at the sediment surface, the feeding and bioturbation zone is shallow. However, the colonization of an azoic soft bottom habitat by Stage I pioneers, often facilitates succession by colonization of additional organisms (Gallagher, et al., 1983). Eventually, the Stage I pioneering benthic invertebrate community is succeeded by a transitional (Stage II) community, which may include deeper burrowing organisms employing additional feeding strategies. The predicted Stage II community is typically characterized by an apparently diverse assemblage of tubicolous amphipods, molluscs, and polychaetes, with most species feeding at or near the surface (Rhoads and Germano, 1986). Some late Stage II communities may also be inhabited by “conveyor-belt species” (species that feed head-down in the sediment surface) although they do not dominate at this stage. In the New Bedford /Fairhaven Lower Harbor, the mactrid pelecypod (*Mulina lateralis*) and the venerid pelecypod (*Mercenaria mercenaria*) are the dominant molluscs, while the spionid (*Streblospio benedicti*) and the capitellid (*Mediomastus ambiseta*) are the dominant polychaetes of the Stage II communities (USEPA, 1996). These organisms will likely provide a source population for further colonization of the CAD site.

In a Stage III equilibrium community, all benthic invertebrate functional groups are represented. That is, the species partition their niche by varying feeding depth, employing different feeding techniques, and represent various feeding guilds (e.g., planktivores, predators, detritivores). Rhoads and Germano (1996) reported that various maldanid, pectinariid, and orbinid polychaetes; caudate holothuroideans; protobranch bivalves; and some infaunal ophiuroids typically dominate the Stage III community. Some Stage I organisms may persist in the Stage III communities.

At this stage of succession, bioturbation and bioirrigation of a deeper sediment layer and higher rates of organic carbon consumption typically prevents anoxic and hypoxic conditions from occurring at the sediment-water interface, down to a 20 centimeter or deeper depth. As the benthic invertebrate community succeeds to Stage III equilibria, the prey availability to finfish may decrease. Stage III benthic invertebrate organisms typically do not exhibit significant seasonal changes in abundance or biomass.

The species that colonize the sand cap would most likely be the same as those from the surrounding benthic invertebrate community. At the Central Long Island Sound Disposal Site (CLISDS), Rhoads et al.

(undated) observed that a sand cap, with trace silt, was colonized by the same organisms (polychaetes and bivalves primarily) as a nearby site that consisted of a silt cap. This suggests that larval recruitment and emigration from surrounding areas was the major factor in recolonization. This implies that the colonization of the sand cap at the proposed preferred aquatic disposal sites, would initially consist of organisms that live in the surrounding area. However, successive colonizing species may be typical of those known to prefer sandier habitat since there is evidence that supports the notion that benthic invertebrate community assemblages are a function of particle size (Kaplan, et al., 1975; Etter and Grassle, 1992). Species preferring sandier substrates may dominate until natural sedimentation of the recessed cell restores the sediment surface to that of the surrounding sediment. The exact species composition of the community is not as important as the functionality of the organism-sediment relationships that form during the successional stages (Rhoads and Germano, 1986).

Additional information would be needed to better predict the benthic impacts on a species level at the proposed preferred aquatic disposal sites. First, the CAD-site specific benthic taxa would need to be identified and their abundance and distribution assessed. This could be done at a later date and the results included in the FEIR. Also, the chemical and physical nature of the existing substrate should be assessed to compare existing conditions with post-cap conditions, to address the influence of pollution as a possible disturbance factor. The progression of successional stages of benthic invertebrate colonization following final capping could be assessed via additional REMOTS® surveillance.

Despite the changes in the benthic invertebrate community, potential impact within the proposed preferred aquatic disposal sites would not be significant for the harbor or region as a whole. The recolonization of the cleaner surface sediments of the cap is expected. However, the duration of succession to a Stage III equilibrium community is not known. The duration of succession to a Stage III community depends on the frequency, degree, and magnitude of other disturbance factors (from both natural and anthropogenic sources) operating on the benthic community.

6.2.2 Commercially and Recreationally Harvestable Mollusks

The proposed preferred aquatic disposal sites do not contain any known commercially or recreationally active shellfish beds. This is due to their proximity to contaminated water or sediment, or due to their proximity to navigation lanes. However, suitable shellfish habitat exists within both sites. The northern (upstream) side of Popes Island North CAD site will impact approximately 13 acres of known oyster, soft shell clam and quahog habitat. The remaining 35 acres of the site will impact habitat suitable for quahog in the same manner (Figure 6-10). This impact would occur initially during excavation of the site, and will continue through UDM disposal, and final capping and cessation of DMMP activities. Impacts would occur mainly as direct removal of individuals and habitat (i.e, during dredging and during excavation of the CAD cells).

Likewise, construction, operation, and final capping of the New Bedford Channel Inner site will impact approximately 60 acres of known quahog habitat (Figure 6-10). Impacts would be similar in magnitude and duration (i.e, during the dredging, disposal, and final capping of UDM) to the Popes Island North CAD site. Of the 60 acres of the impacted quahog habitat that would be impacted at the Channel Inner site, approximately 11 acres are designated by the DMF as "Shellfish Contaminated Relay Area No. 1" (Figure 6-11). Contaminated relay areas are designated as potential harvest sites with subsequent depuration. The

northeastern corner of Shellfish Contaminated Relay Area No. 1 would receive direct impacts from construction, operation, and final capping of the Channel Inner CAD site.

Following final capping and closure of the CAD site, shellfish habitat would return. However, should the areas of the CAD cells become anoxic following capping, and sulfidic conditions develop at the sediment-water interface, larval settlement of shellfish may be delayed until oxic conditions are re-established. Given that recolonization of disposal mounds is influenced, at least in part, by the benthos of the surrounding area and the larvae in the water column (Maurer et al., 1982a,b; Rhoads et al., 1978), quahog and soft shell clam are expected to recolonize the area. However, recolonization of the benthic environment by invertebrates is expected to occur in successional stages (Stages I, II, III). Stage I organisms (typically polychaete or oligochaete annelids) will recolonize first, followed by succession to Stage II and Stage III. Higher trophic level benthos such as most bivalve molluscs are typically part of the later stages (Rhoads et al., 1978). Monitoring will be needed to track the progress of recovery. Providing seed stock to the area could speed recovery.

6.2.3 Lobsters

All of New Bedford/Fairhaven Harbor is closed to the commercial harvest of lobster. Therefore, data on lobster distribution and abundance within the Acushnet River Estuary is not available from commercial lobstering data sources (V. Malkoski, Personal Communication). No surveys of early benthic phase (EBP) or juvenile lobsters were conducted in New Bedford/Fairhaven Harbor. Predictions regarding impact to this resource at the proposed preferred aquatic disposal sites were made based on the limited information obtained during finfish sampling in the harbor (NAI, 1999) and based on the limited information obtained during REMOTS® surveys of the benthic habitat at stations within the proposed CAD sites.

The proposed preferred aquatic disposal sites (Channel Inner, and Popes Island North) lie within closed fisheries areas. Therefore, disposal of UDM within these sites would not have a significant impact on the lobster fishery of New Bedford/Fairhaven Harbor, unless these areas contained a high density of early benthic phase lobsters, or gravid females that may disperse into the Outer Harbor and adjacent regions. No lobsters were caught during 12 months of seine and trawl fish sampling in the Inner or Outer Harbors of New Bedford.

Adult lobsters will likely be able to avoid dredging and disposal activities. If the lobsters are buried during disposal, they will be able to vertically migrate to the sediment surface, as will other strong burrowers (Maurer et al., 1982b; Nichols et al., 1978). Although the soft silt/mud substrate conditions which dominate the harbor are not preferred habitat for adult lobster (Hudon, 1987; Wahle and Steneck, 1991) dense lobster habitation can occur in muddy substrates (Berrill and Stewart, 1973; Berrill, 1974; Botero and Atema, 1982). For instance, the results of recent sampling within Gloucester Harbor, Massachusetts (NAI, 1999) indicate that adult and juvenile lobster will use the habitat of soft-bottom environments. Because of the abundance of lobster in the immediate area, emigration of lobsters from outside the disturbed area is expected. Such movement has been recorded at disposal sites in New England, including the NLDS (NOAA, 1975).

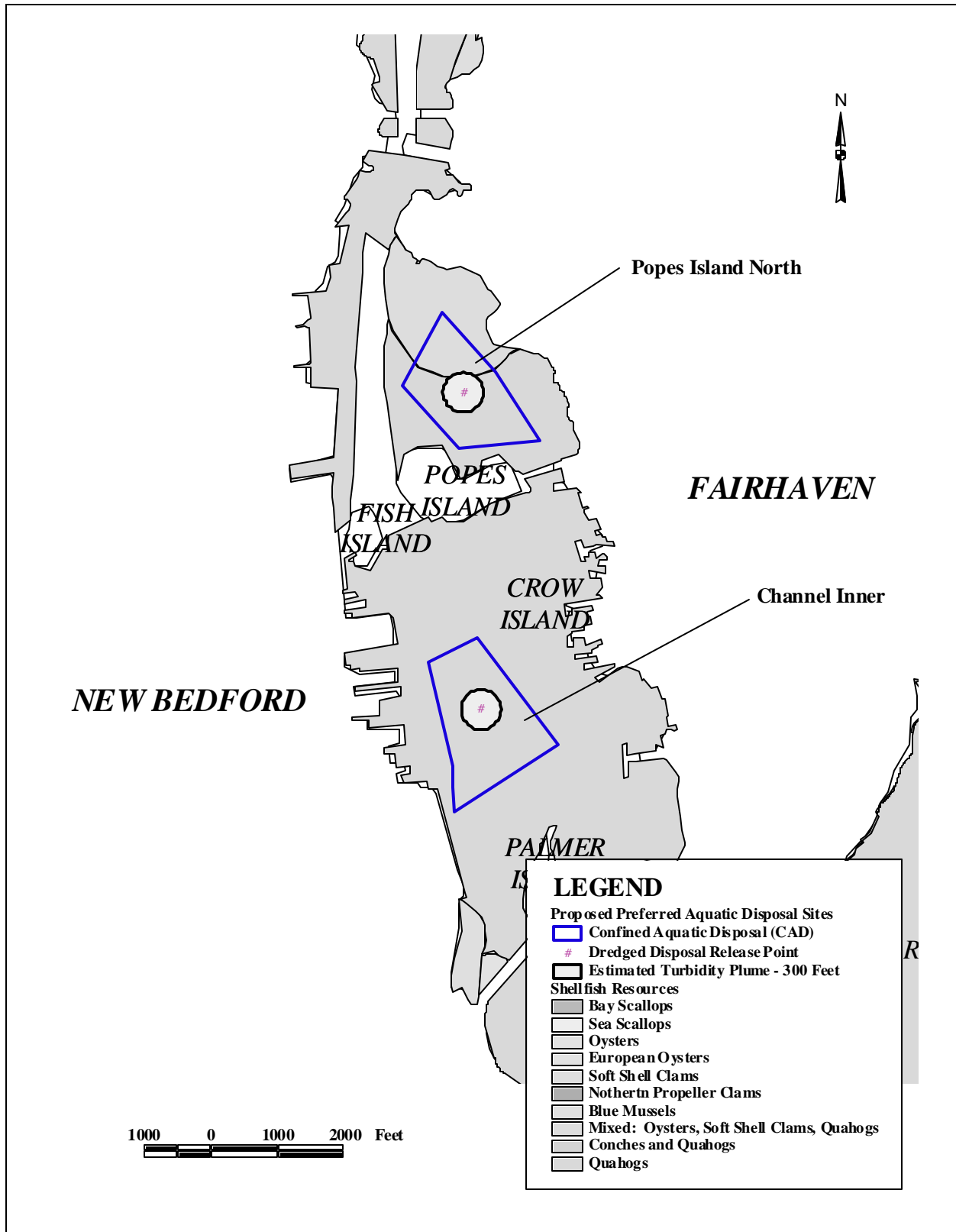


Figure 6-10: Shellfish Resources at the Proposed Preferred Sites

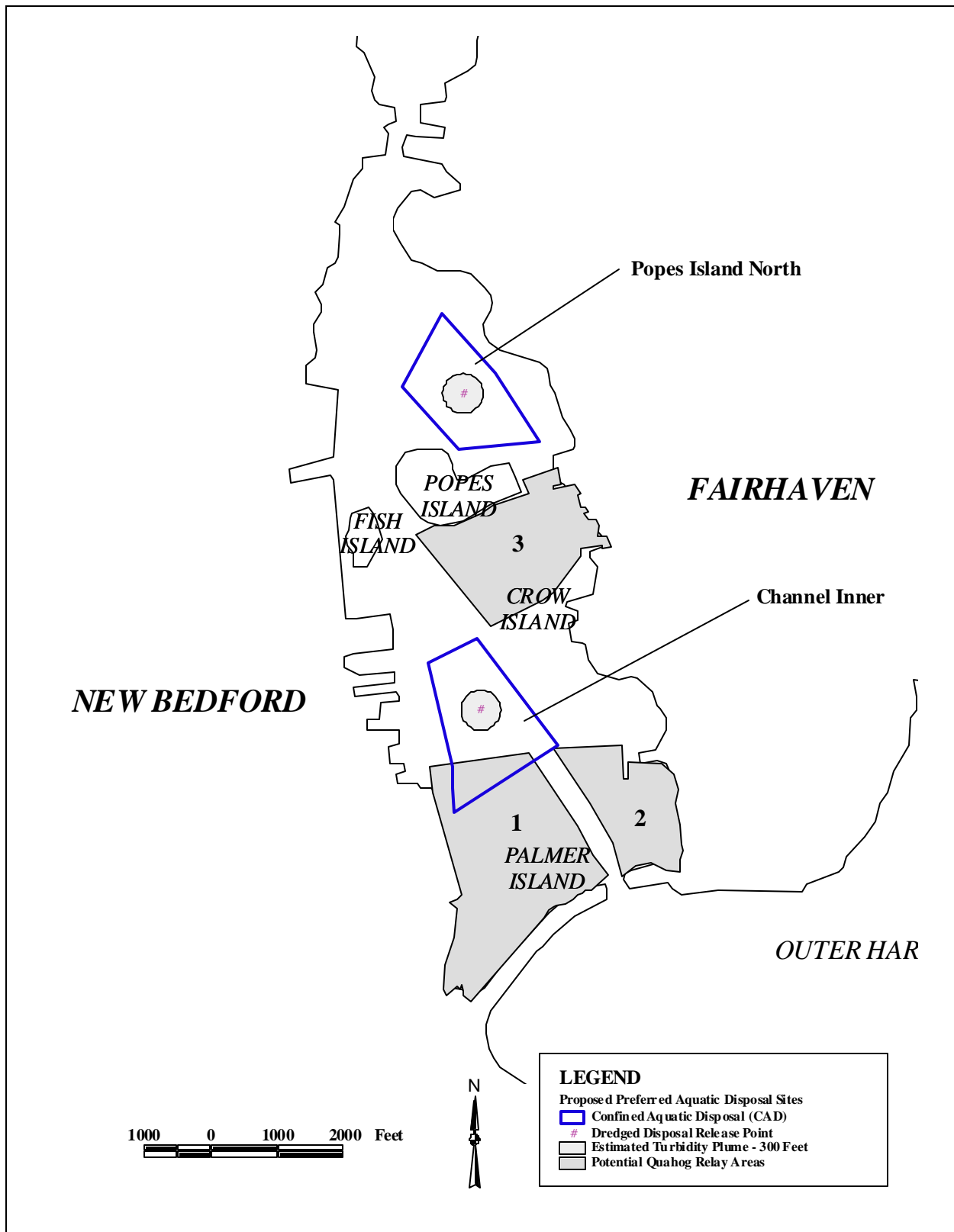


Figure 6-11: Potential Quahog Relay Areas at the Proposed Preferred Sites

The lobster habitat in the vicinity of Popes Island has not been surveyed. Therefore, it is not known if this area supports a population of early benthic phase or adult lobsters. Lobsters prefer a complex benthic substrate containing cobbles, boulders, or rocky reefs in which to seek out crevices and holes for cover. In the absence of hard substrate structures, they are capable of excavating a burrow in the sediment. However, most benthic habitat that supports a substantial lobster population has some rock structure mixed in with the softer sediment. Within these benthic habitats, lobsters will excavate burrows beneath or alongside the rock substrate.

Results of REMOTS® imaging obtained at sampling stations within or proximal to the preferred alternative sites, show that the habitat within the Popes Island North CAD site contains a silty, soft bottom. The habitat of the Channel Inner site contained a muddy soft bottom. These substrate types are not likely to support a substantial lobster population, and is the least preferred habitat by lobster for colonization and settlement. Should some lobsters inhabit the area, creation of a CAD, disposal of UDM, and capping would directly impact these individuals through physical disturbance. Regardless of the benthic habitat adult lobsters, should they occur in the area of the CAD sites, would leave or avoid the disturbance. However, as reported for the 12-mile Sewage Sludge Dumping site in the New York Bight, pre-disturbance lobster abundance would most likely rebound following cessation of UDM disposal and final capping (Wilk et al., 1995). Therefore, no substantial impact to lobster habitat would occur as a result of CAD construction, operation, and final capping.

6.2.4 No Action

If there is no action, sediments will remain in their present condition. The nature of the benthos would not be expected to change in any predictable way. Contaminants within the sediment would continue to impact the benthic invertebrate community, particularly in the Upper and Lower Harbors. The invertebrate community of the various harbor areas would be expected to exhibit a similar assemblage as that described by USEPA (1996). The Upper Harbor areas would continue to exhibit a high abundance of opportunists, low evenness, and low species diversity presumably due to impact from point and non-point pollution. The benthic invertebrate community of the Lower Harbor would continue to exhibit a greater diversity than the Upper Harbor, but the community would still show signs of impact. The Outer Harbor would continue to exhibit a higher species richness but opportunistic species would still dominate the community assemblage. The Outer Harbor represents an even distribution of dominant species when compared to the benthic invertebrate communities of the Upper and Lower Harbors.

6.3 Finfish

Little is known about the specific fishery resources at each proposed Preferred Aquatic Disposal site. However, the fishery of the Harbor, in general, has been characterized from various studies (Howes and Goehringer, 1996; Normandeau Associates, Inc., 1999). The Channel Inner site provides moderate to high nursery potential for scup, cunner, black sea bass, winter flounder and northern pipefish. The Popes Island North site provides low to moderate nursery potential for mummichog, cunner and winter flounder.

Dredged material disposal will have the greatest impact on fishes which are dependent on the bottom. Little to no impact will occur to pelagic fishes, since they are very mobile and can readily avoid the temporary areas of turbidity in the water column. Also, many fish popular with sport fishermen, such as black sea bass, striped bass, and tautog are found mainly near shoal, rocky areas and ledges, rather than the muddy channel and adjacent-to-channel areas proposed for dredge disposal.

Short-term impacts to fish in the upper to mid-water column at the proposed Preferred Aquatic Disposal sites would occur during excavation of the CAD pits, the disposal of UDM, and the construction of the sand cap. Most short-term impacts are associated with suspended sediment or turbidity plumes created during excavation, disposal, and capping. Increased barge activity can also have short term impacts to fisheries by invoking avoidance response. Various behavioral effects and some sublethal effects (physical stresses) can be considered short-term impacts, since fish behavior could return to normal and the sublethal effects could be reversed or eliminated following disturbance (Newcombe and Jensen, 1996). Some fish, especially highly mobile, migratory or pelagic species, are capable of fleeing the area during these events and would return once these activities cease. Although these impacts are unavoidable, they are short-term in nature (minutes or hours).

Moderate to severe sublethal effects, lethal or para-lethal effects may be irreversible and long lasting. They may be associated with habitat degradation, reduced growth rate, delayed hatching, increased predation, and various levels of mortality (Newcombe and Jensen, 1996). These effects may be incurred via direct burial by sediment, exposure to suspended sediment, or via major alterations of their habitat that results in substantial changes to food source, water quality, flow regime, or biotic interactions (Karr, 1991).

Efforts were made during the site selection process to avoid high quality fish habitat (e.g., spawning shoals, rock reefs). Generation of suspended sediment plumes is harder to avoid in an environment such as a tidally influenced estuary. The severity of the effect of the suspended sediment on fish is a function of sediment concentration, duration of exposure, concentration of contaminants within the sediment, particle size, and particle morphology (Newcombe and Jensen, 1996). The susceptibility of various fish species to these potential ill effects is a function of one or more of the following: their taxonomic group, natural history, life history phase, and health status prior to exposure.

Winter flounder, one of the most important fishery species in the area, are bottom spawners with demersal eggs that stick to bottom substrate. Although they have pelagic larvae, winter flounder live on the bottom for most of their life cycle. They spawn during February and March in Massachusetts waters, and the eggs hatch in about 15 to 18 days (Bigelow and Schroeder, 1953). There could be an adverse impact on spawning and egg development from dredge disposal unless disposal is restricted during this time, which is typically February through May.

Being demersal fish, winter flounder would be most susceptible to direct impact during UDM disposal. The egg, embryonic, and larval stages of winter flounder (and most other fish) are most susceptible to mortality and injury (Blaxter, 1969, 1974; Bannister et al., 1974; McGurk, 1986; Black et al., 1988; Chambers et al., 1988). Eggs are found in bottom habitats with sand, mud, and gravel substrates where water temperatures are less than 10°C (50 °F), salinities range between 10 and 30 ‰ and water depths are less than 5 meters (16 feet). Larvae typically inhabit open water and benthic habitats in areas where the sea surface water temperatures are less than 15°C and the salinity ranges from 4 to 30 ‰. Juveniles are also found in bottom habitats with a substrate of mud or fine-grained sand. They typically occupy waters from

0.1 to 10 meters (0.3 to 33 feet) deep, and areas where the water temperature is below 28°C (82 °F) and where the salinity is between 5 and 33 ‰. Adults have similar benthic habitat substrate requirements. They are typically found in waters 6 meters (20 feet) deep, at temperatures below 15°C (59 °F), and within waters with a salinity between 5.5 and 36 ‰ (Pereira et al., 1999).

Scup could also be susceptible to direct impact during UDM disposal. Eggs and larvae are found in the water column from mixing to seawater salinity zones. Eggs appear from May to August in waters with temperatures between 13-23 °C (55-73 °F) and salinity greater than 15 ‰. Larvae have similar temperature and salinity requirements. Due to their relative immobility, eggs and larvae would not be able to escape the suffocating effects of burial during UDM disposal. Therefore, eggs and larvae are most susceptible to UDM disposal. Juvenile scup, although more mobile, are found in demersal waters in bays and estuaries during the summer and spring. They frequent areas where the substrate is composed of various sands, mud, mussel and eelgrass bed types. Scup require water temperatures > 7°C (> 45 °F) and a salinity greater than 15 ‰ (Steimle et al., 1999a). Therefore, they would be expected to occur within the disposal areas and may be impacted by UDM disposal.

Black sea bass juveniles enter estuarine waters upon development from larval stages. They can be found at varying depths from the surface down to 38 meters (125 feet). Black sea bass are typically found around the edges of salt marshes and channels, preferring a rough bottom substrate such as shellfish, sponge or eelgrass beds, and nearshore patches of man-made objects. Adults tend to congregate around rock jetties, rocky bottom substrate areas, and areas underlain by sand and shell fragments (Steimle et al., 1999b). In areas where these substrates would be covered during UDM disposal, impact to black sea bass juveniles can be expected.

Flounder and other demersal fish species may benefit shortly after disposal ceases and the site is capped. Bigelow and Schroeder (1953) report that winter flounder are most often caught on muddy sand, but may be found on a variety of bottom types. Flounder typically spawn on a sandy bottom substrate. Since the sediments at the proposed Preferred Aquatic Disposal sites lack sandy areas, the area may become more attractive for these fish if the site is capped with sand or sand with some silt. Over time, the silt fraction may accumulate in the shallow depression of the CAD site and the substrate may revert back to its original soft-bottom condition. In addition, the formerly contaminated sediments that originally comprised the benthic substrate of the CAD cell would be replaced with clean sediments, following operation of the CAD site. The newer, cleaner sediments may encourage settlement and formation of more robust benthic invertebrate communities in an area where they were formerly impacted by degraded sediment. The abundance of early colonizing invertebrates at the sediment surface are readily available to demersal predators and may benefit the various groundfish, including winter flounder, that inhabit the harbor. Given the geographic range and distribution of finfish within the harbor, the temporal and spatial scale of disturbance and resultant potential impact to finfish associated with UDM management is insignificant.

6.3.1 No Action

If there is no action, fisheries will remain as at present, with the exception of changes not related to dredge or disposal of UDM, such as those caused by natural cycles or over-fishing.

6.4 Wetlands

6.4.1 Coastal Wetlands

As reported in Section 5.2.5.1, there are no federally designated coastal wetlands or salt marshes within the vicinity of the proposed preferred aquatic disposal sites, nor within the three hundred foot zone of influence of the disposal site. Therefore, there will be no effect on these resources in the Harbor (Figure 6-12).

However, the entire area within the footprints of the proposed preferred aquatic disposal sites lie within wetlands regulated by the Commonwealth of Massachusetts. The proposed preferred aquatic disposal sites overlap state-regulated wetlands areas classified as “Land Under Ocean” and “Land Containing Shellfish” according to the DEP wetland regulations under the Massachusetts Wetlands Protection Act (310 CMR 10.00). The activities related to UDM management may diminish the fish and shellfish habitat, production export, and wildlife habitat functions and values provided by these wetland resource areas in ways discussed in the respective sections of this document (e.g., Section 6.2 - Benthos, Section 6.3 - Finfish, and Section 6.5 - Wildlife). The areal extent of the impact is approximately 60 acres for Popes Island North CAD Cell site, and approximately 40 acres for the Channel Inner CAD Cell site. Activities within these wetland areas are subject to regulation under 310 CMR 10.25 for Land Under Ocean, 310 CMR 10.34 Land Containing Shellfish, and procedures established under 310 CMR 10.37 for protection of rare vertebrate or invertebrate species (Section 7.1.1).

6.4.2 Submerged Aquatic Vegetation

Submerged aquatic vegetation (SAV), consisting mostly of eelgrass beds in this area, are not located within the vicinity of the proposed preferred aquatic disposal sites or their three hundred foot zone of influence. The nearest recorded eelgrass bed to any of the proposed preferred aquatic disposal sites is located approximately 0.45 miles east of the main navigation channel, outside of the Hurricane Barrier. One of the many functions and values of eelgrass beds is that they filter suspended sediments from the water column by reducing current and wave energy. Potential impacts of dredging and disposal, depend on many environmental conditions including current speed and direction, tides, UDM disposal volume, sediment water content, and other factors. However, as the nearest bed lies well beyond the expected 300 foot turbidity zone and outside of the Hurricane Barrier, no negative impacts to SAV are expected.

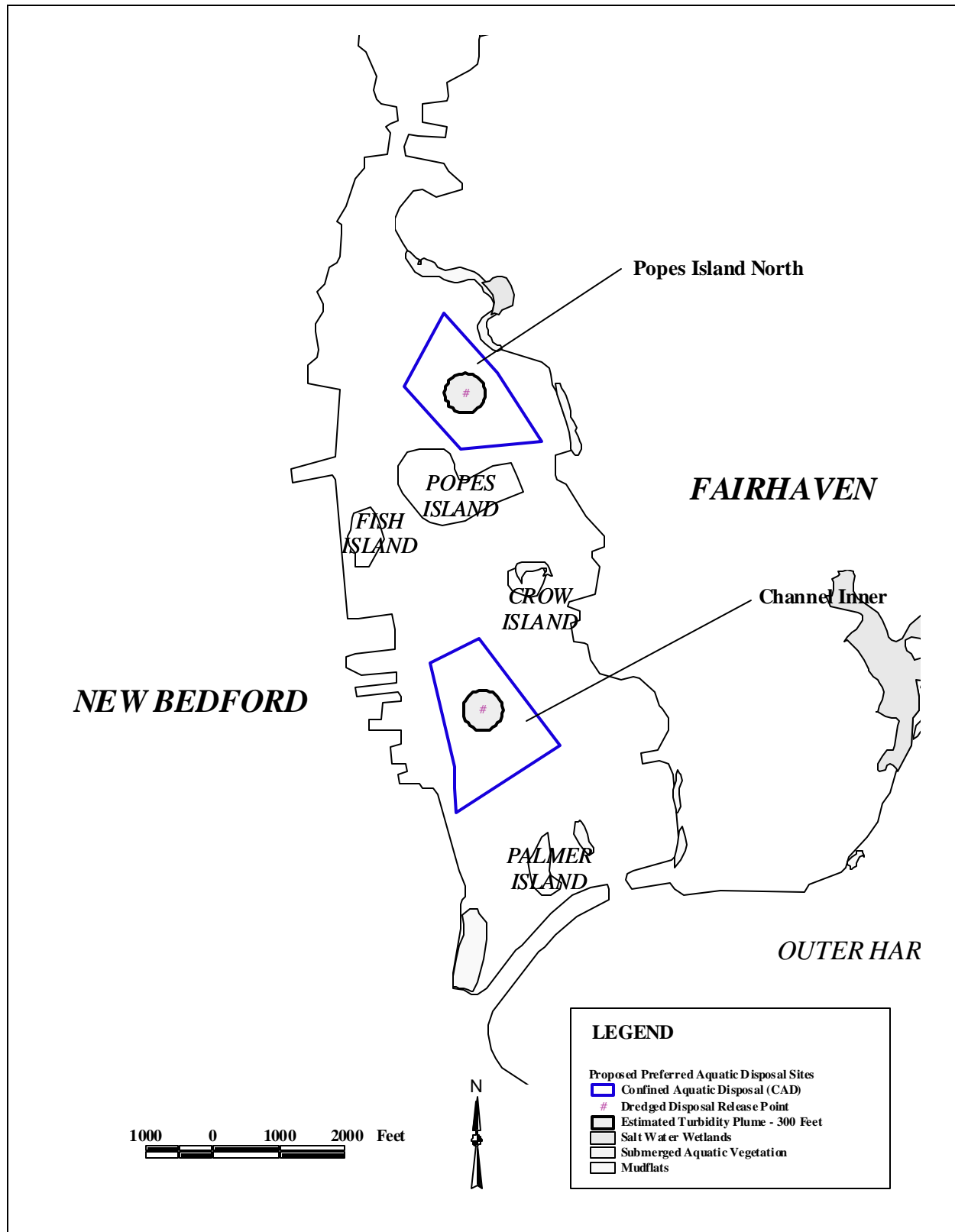


Figure 6-12: Coastal Resources in the Vicinity of the Proposed Preferred Aquatic Disposal Sites

6.4.3 *Intertidal Habitats*

The closest mudflats to the proposed Preferred Aquatic Disposal sites lie within 0.05 miles northeast of the Popes Island North site and approximately 0.3 miles south of the New Bedford Channel Inner site. These mud flats also lie beyond the expected influence of dredging and disposal, based upon the hypothetical release point. In the FEIR, detailed dredged material release points will be identified for the Popes Island North site that will not be closer than 300 feet from the eastern cell edge, to ensure a minimum 250 foot buffer to intertidal habitat. By maintaining the buffer, no adverse effects to the mudflats in the vicinity of Popes Island North are expected.

6.4.4 *No Action*

If the proposed preferred aquatic disposal sites and vicinity were not to be used as a disposal site, existing wetland resource areas at and near the site would remain unchanged.

6.5 *Wildlife*

6.5.1 *Avifauna*

Tidal flats are important shorebird feeding habitat. Since no tidal flats are located in close proximity to the preferred alternative disposal sites, impacts to shorebird habitat from suspended sediments or covering of feeding areas via siltation will be negligible. No loss of shorebird breeding habitat (e.g., salt marsh, sand or cobble beach) will occur from either dredging or disposal of UDM within either of the proposed preferred aquatic disposal sites. The Pope's Island North site has limited intertidal habitat adjacent to the northern shoreline of Pope's Island because the shoreline at this location has been altered by construction of a seawall with a steep, almost vertical slope. Construction of this abrupt edge has limited the formation of intertidal habitat to compressed vertical zones on the seaward side of this edge. Since this narrow intertidal zone lies outside the footprint of the proposed CAD cell, no intertidal habitat would not be lost through construction of the Pope's Island North CAD site.

Depending on the species, seabirds such as gulls and terns forage in a variety of marine habitats such as the open water surface, along beaches, on tidal flats, within salt marshes, or within a combination of these habitats. Certain species are well adapted to human activity and may forage in urban environments. No loss of seabird foraging or breeding habitat will occur during dredging. However, dredging of marine sediments may cause temporary suspension of benthic invertebrate macrofauna in the upper water column. Here the invertebrates may be eaten by gulls or terns. Benthic invertebrate macrofauna may also be gleaned by gulls from excavated sediment temporarily stored on scows.

The various species of waterfowl (loons, grebes, ducks, etc.) that frequent New Bedford/Fairhaven Harbor reach their greatest concentrations in winter. They tend to congregate in areas of abundant food supply proximal to shellfish beds, and areas where marine fish congregate such as rocks, ledges and reefs. The dredging and disposal of marine sediment will result in the loss of some shellfish habitat but will have minimal impact to reefs and other submerged structures. Fish concentrations will avoid the temporary disturbances to the water columns during dredging and disposal of marine sediments. Therefore loss of waterfowl

foraging habitat is expected to be negligible. No loss of waterfowl breeding habitat will occur since all dredging and disposal will occur in open water areas.

6.5.2 Reptiles

Sea turtles, the only marine reptiles of the area, are not an important part of the fauna in the New Bedford/Fairhaven area and are rarely seen in the harbor. Any effect on the water column from dredge disposal will not extend to the open ocean where these animals live, therefore none of the preferred alternative disposal scenarios will affect marine reptiles.

6.5.3 Marine Mammals

As discussed in Section 5.3.5.2, the marine mammals of the region, with the exception of the harbor seal, are unlikely to be found in the vicinity of the proposed preferred aquatic disposal sites and therefore should not be affected by dredging and disposal activities. Furthermore, the sheltered and undisturbed rocky ledges preferred by harbor seals will not be impacted by disposal operations. In addition, seals are very mobile and easily able to avoid the limited area of the harbor impacted by disposal. The fish on which they feed will tend to be most abundant near the rocks and ledges where sport fishing is most productive, rather than at the muddy bottom of the preferred disposal site.

6.5.4 Endangered Species

As discussed in Section 5.3.5.4, five whales and two turtles, federally listed as endangered, occur in the ocean outside of New Bedford/Fairhaven Harbor and Buzzard's Bay. These species rarely (whales especially) occur within New Bedford/Fairhaven Harbor, or close enough to be affected by any indirect impacts of the project, such as turbidity or release of contaminants. Therefore, the project will have no impact on any endangered or threatened species.

6.5.5 No Action

If there is no action, the wildlife resources of the area, including endangered species, would not be affected.

6.6 Historic and Archaeological Resources

The proposed preferred aquatic disposal sites would be constructed entirely under water in New Bedford/Fairhaven Harbor. This fact, combined with the distance to the nearest significant land-based historic resources, such as Fort Phoenix Beach State Reservation to the northeast of the East of Channel Aquatic Disposal Site, will result in no impacts to shore-side historic resources in New Bedford/Fairhaven.

However, there is potential for impacts to yet undiscovered underwater historical and archaeological resources, as discussed below.

6.6.1 Historical Shipwrecks

The nearest known shipwrecks (currently unidentified at this stage of the investigation), lie outside of the footprints and associated zone of influence of the proposed preferred aquatic disposal sites in New Bedford/Fairhaven Harbor. However, the historical record of shipwrecks in New Bedford/Fairhaven Harbor is not complete. As a result, there is potential for as yet undiscovered historic shipwrecks to occur anywhere in New Bedford/Fairhaven Harbor, including the proposed preferred aquatic disposal sites. Because much of the Lower Harbor has been previously dredged (for maintenance of the navigation channels and maneuvering areas), the likelihood of encountering the remains of shipwrecks during future dredging, is lessened. Nevertheless, a field survey has been proposed to determine if there are shipwreck remains at the proposed preferred aquatic disposal sites. See Appendix H for details.

6.6.2 Archaeological Resources

New Bedford/Fairhaven Harbor has a long maritime history and the Harbor is considered to be an area of archaeological sensitivity. The proposed Preferred Aquatic Disposal sites are not located in the vicinity of any known archaeological resource in New Bedford/Fairhaven Harbor, although there is limited information on Native American sites within or proximal to the Harbor. Because of this paucity of information, and the fact that the proposed preferred aquatic disposal sites are near-shore and may have once been above sea level, there is a possibility of previous Native American activity in the area.

Remains of any sites would be extremely hard to locate under the sediment in the survey area. Remote sensing surveys will generally not indicate a prehistoric site in this type of topography. Locating prehistoric Native American sites would require archaeological trenching of each proposed impact area.

6.6.3 No Action

If the preferred aquatic disposal site in New Bedford/Fairhaven Harbor is not constructed, there would be no further disturbance of the site and therefore no impacts to extant underwater historic or archaeological resources. Any shipwrecks or colonial or aboriginal artifacts, if present at the site, would not be discovered, recovered, recorded, or preserved.

6.7 Navigation and Shipping

As detailed in Section 5.3.7, existing commercial navigation in the harbor is largely divided into three primary categories: 1) traffic related to commercial fishing, 2) fish processing industry and, 3) other maritime vessels and recreational boats. Construction and use of the proposed preferred alternative sites will pose minimal impacts to existing navigation and shipping in the harbor, provided disposal activities are managed and coordinated closely with New Bedford and Fairhaven's Harbormasters. Issuance of navigational advisories will help place infrequent maritime harbor visitors on notice of disposal activities. Additionally, because disposal will only take place for one season during each planning horizon, opportunity for adequate public notice to frequent harbor users will be provided.

Use of the Channel Inner site will also result in increased traffic through the Hurricane Barrier associated with UDM delivery from Outer Harbor dredging projects. Because of its location within the navigation channel, the Channel Inner site could interfere with safe navigation. This could be mitigated by placement of buoys around the work area and notifications to mariners through Coast Guard advisories. As noted above, close coordination with Harbormasters will be essential to maintaining the smooth flow of vessel traffic within the Inner Harbor.

The nature of the construction of CAD disposal cells will not result in any reduction of navigable depth in New Bedford/Fairhaven Harbor. The three foot thick sand caps proposed for all of the disposal cells of the CAD preferred alternative sites will maintain existing bottom depths and not protrude into the water column any higher than existing conditions. After the completion of disposal activities for each planning horizon, navigational and shipping conditions in the vicinity of the disposal cells will return to preexisting conditions.

The presence of a CAD at Popes Island should not negatively affect long-term navigation. The federal navigation channel's northern terminus is east of the existing Popes Island and would not be encroached upon by the CAD. Small craft should be able to maneuver over the CAD to access deeper water east of Popes Island. However, temporary impacts during construction and dumping could be experienced, requiring coordination to minimize conflicts in movements.

6.7.1 No Action

If the preferred aquatic disposal site in New Bedford/Fairhaven Harbor is not constructed and UDM from dredging projects in the Harbor is not able to be disposed of cost-effectively, maintenance and planned improvement dredging projects may not be undertaken. Historical rates of sediment accumulation will continue and navigation channels, anchorage areas, turning basins, marine terminals, marinas and boat ramps in the harbor would gradually silt in. Navigation would become increasingly difficult in the harbor, compromising economic development.

6.8 Land Use

There would be no direct or indirect permanent impacts to land use in New Bedford/Fairhaven Harbor as a result of construction or UDM disposal activities at the proposed preferred aquatic disposal sites. These sites are aquatic sites, constructed entirely under water and therefore not visible from near shore areas.

Shoreline land use in the vicinity of the proposed preferred aquatic disposal sites is a mixture of residential, commercial, and industrial. Dredging and disposal, would involve the use of heavy machinery such as cranes and barges, therefore, residential areas may bear temporary noise impacts during a typical 8-hour working day.

Although there are nearby recreational areas (e.g. municipal parks and various marinas), these are most active in the warm-weather months when dredging and disposal would cease. Therefore, the activities at these sites would be only minimally negatively affected.

Indirect impacts from the construction of the proposed preferred aquatic disposal sites are expected to be positive. The presence of a cost-effective solution to disposal of UDM from harbor dredging projects will help to maintain the economic viability of the existing marine facilities and associated recreational and commercial land uses along the New Bedford/Fairhaven Harbor shoreline.

Construction of the Proposed Preferred Aquatic Disposal sites in New Bedford/Fairhaven Harbor is consistent with the stated goals of the New Bedford/Fairhaven Harbor Plan. The presence of the proposed disposal site will encourage the anticipated public and private dredging projects in the harbor to be undertaken and will provide a cost-effective, local disposal option for the UDM from those dredging projects. The New Bedford/Fairhaven Harbor Plan encourages the finding a solution for the disposal of UDM associated with the public and private dredging projects identified in the Harbor Plan.

6.8.1 No Action

If the preferred aquatic disposal site is not constructed, the existing industrial land use in the vicinity of the disposal site will likely remain unchanged for the foreseeable future. Over the long term, if planned private and public dredging projects in New Bedford/Fairhaven Harbor are not undertaken due to the lack of a cost-effective disposal option for UDM, then water-side land use patterns along the New Bedford/Fairhaven shorefront may change (e.g. industrial/commercial land use may decline due to reduced access to shipping ports). Access to recreational boat slips may also decrease.

6.9 Air Quality / Noise

6.9.1 Air Quality

Air quality impacts from the construction of the CAD cells and UDM disposal activities at the Proposed Preferred Aquatic Disposal sites in New Bedford/Fairhaven Harbor are expected to be minor, and temporary in nature. Impacts will result from the operation of heavy construction equipment, such as dredges and tugboat engines, and from the potential release of volatile organic compounds and the escape of odors from temporary storage of UDM on barges.

During construction, operation of the clamshell dredge will result in emissions from the diesel engine of the dredge. Among the chemicals emitted will be nitrogen oxide (NO_x) and Volatile Organic Compounds (VOCs), two EPA Priority Pollutants that are precursor of ozone. Emissions of these pollutants would be minimized through the use of proper emission controls on the diesel engine, the use of equipment that complies with emission standards, and by the temporary nature of the activity. All dredging equipment will be equipped with proper air pollution control equipment and mufflers as required by DEP regulations.

A study done by the U.S. Navy (1995) estimated the total emissions of VOC and NO_x from a 1.1 million cy dredging and disposal project that was completed within one dredging season (approximately 4 months). It was forecast that 0.9 tons of VOC and 6 tons of NO_x would be emitted from the various construction equipment (barges, tugs, cranes). Similar emissions would result from the dredging and disposal in New Bedford/Fairhaven, but these emissions would be distributed over a 20-year period.

To construct the proposed aquatic disposal site, silts from the harbor bottom must be dredged and temporarily stored on barges or on land until this material is disposed of in the CAD cell. This material is assumed to be unsuitable for unconfined ocean disposal. The construction process for the CAD cell is illustrated in Figure 6-2. Depending on the location of the temporary stockpile and the length of time it is necessary to stockpile the material, minor air quality impacts may result.

Odors, occurring primarily as a result of the anaerobic decomposition of organic materials in the dredged sediments, may pose objectionable impacts. This can be controlled, if necessary, with the mixing of lime (which neutralizes odors) into the UDM. Volatilization of organic compounds in the UDM may occur if the temporary stockpiling occurs over a period of time sufficient to result in the drying of the UDM. A covering of water over the UDM prevents the volatilization of organic compounds in the UDM. Overall, volatilization is not expected to be a concern as the duration of the temporary stockpiling activities is expected to be minimal, preventing the complete drying of the UDM stockpiles.

Other factors that determine the degree of air quality and odor impacts include temperature (colder temperatures slow bacteria growth on dredge material and lessen odor impacts), wind direction, and proximity of residential areas.

6.9.2 Noise

CAD cell construction and UDM disposal activities will result in temporary and localized minor noise impacts at the Proposed Preferred Aquatic Disposal sites nearby waterfront residential and recreational locations. Given the mixture of abutting industrial and residential land use, this potential impact is considered relatively minor since local residents are somewhat accustomed to sounds of harbor commerce. The use of construction and dredging equipment that is properly equipped with mufflers, and by conducting CAD cell construction and UDM disposal activities during daytime hours, these impacts will be reduced or minimized.

6.9.3 No Action

If the preferred aquatic disposal site is not constructed in New Bedford/Fairhaven Harbor, there will be no additional temporary air quality, odor and noise impacts in the vicinity of the disposal site.

6.10 Recreational Resources

The nearest shoreline recreational areas include Fort Phoenix Beach State Reservation located approximately 0.5 miles to the south. Other recreational resources include various marinas located throughout the Inner Harbor. Construction of the proposed preferred aquatic disposal sites in New Bedford/Fairhaven Harbor will not directly impact these recreational resources. Indirect impacts may include temporarily increases in noise but harbor dredging and disposal would not directly impact recreational fishing.

Recreational boaters are numerous in New Bedford/Fairhaven Harbor. Recreational impacts will be limited because of seasonal restriction on dredging and disposal, and the boaters may need to potentially avoid the dredge and dump scows during activities at the proposed disposal sites and seek alternate routes to navigation channels.

6.10.1 No Action

If the preferred aquatic disposal sites in New Bedford/Fairhaven Harbor are not constructed, there will be no direct impacts to recreational resources in the harbor. However, over time, the lack of a cost-effective disposal site for the disposal of unsuitable dredge material from dredging projects in the harbor may result in the loss of moorings at harbor mooring areas and slips at local marinas or access to public boat ramps, impacting recreational boaters in the area.

6.11 Economic Environment

As New Bedford/Fairhaven Harbor enters the next century, economic development activity for the harbor is expected to center on seafood/ maritime industries, tourism and recreational activities. The Harbor Plan envisions a harbor that balances the fishing and tourism industries to mutually complement each other. The proposed expansion of terminal/berthing areas for commercial fishing activities is coupled with plans to improve recreational activities, facilities and improve public access along the waterfront. Implementation of the specifics of the Harbor Plan will require an immediate investment of \$12 million dollars, of which \$7 is already secured. This investment is expected to leverage the creation of 700-800 private sector jobs and \$50-\$60 million dollars in private investment (Harbor Plan, 1999).

The improved marketing and condition of the harbor envisioned in the plan is also projected to attract an additional 120,000 visitors, a 60% increase, with gross receipts of approximately \$4 million. Additional need for 200 recreational slips is also expected. Based upon the preliminary success of the quick start ferry terminal, the plans vision of capturing the wholesale business to support the ferry service could support 125-150 full time jobs and between \$50-75 million in new wholesale business (Harbor Plan, 1999).

Table 6-4: Immediate-Term - 5 Year Plan and Additional Near Term 5-Year Plan
Implementation Costs

Investments	Estimated Cost
<i>Immediate-Term - 5 Year Plan</i>	
<i>Freight Ferry</i>	\$4 million
<i>Charter Excursion Dock/Related Improvements</i>	\$2 million
<i>Fishing Pier Extensions</i>	\$2.7-3.6 million
<i>Pier and Wharf Repairs</i>	\$2.2 million
<i>Water Taxi Dock</i>	\$75K
<i>Standard Times Field Infrastructure</i>	\$525K
<i>Fairhaven Pease Park Boat Ramp/Taxi Dock</i>	\$125K
<i>TOTAL</i>	\$12 million
<i>Funding Already Committed</i>	\$12 million
<i>Additional Near Term - 5 Year Plan</i>	
<i>Route 18 Enhancement</i>	\$15 million
<i>Maintenance Dredging (users/driveways)</i>	\$20 million
<i>TOTAL</i>	\$35 million
<i>Funding Already Committed</i>	\$15-33 million

Source: New Bedford/Fairhaven Harbor Plan, 1999

In addition to the investments being made to implement the Harbor Plan, the proposed remedy to address PCB contamination is expected to be over \$141 million (Table 6-5) and proposed projects by the New Bedford Harbor Trustee Council are over \$9 million (Table 6-6).

Table 6-5: Superfund Costs - Estimated Cost of the 1996 Proposed Remedy

ACTIVITY	COST
<i>I. DIRECT COSTS</i>	
<i>Dredging</i>	\$22,320,348
<i>Dewater/Water Treatment</i>	\$27,123,051
<i>CDF Construction</i>	\$27,121,318
<i>Air Monitoring</i>	\$2,148,800
<i>Total Direct Cost (TDC)</i>	\$78,713,517
<i>II. INDIRECT COSTS</i>	
<i>Health and Safety (Level D Protection)</i>	\$3,935,676
<i>Legal, Administration, Permitting</i>	\$7,871,352
<i>Engineering</i>	\$7,871,352
<i>Services During Construction</i>	\$7,871,352
<i>Turnkey Contractor Fee</i>	\$11,807,028
<i>Total Indirect Costs (TIC)</i>	\$39,356,759
<i>TOTAL COSTS</i>	
<i>Subtotal TDC+TIC</i>	\$118,070,276
<i>Contingency (20%)</i>	\$23,614,055
<i>Total Capital Cost</i>	\$141,684,331

Source: USEPA - ROD II, 1998

Compatibility with the Harbor Plan

Furthermore, the selection of a disposal site for UDM, as a concept, is supported by the New Bedford/Fairhaven Harbor Plan, which recommends the pursuit of the maintenance and improvement dredging projects in the harbor and a disposal site for the UDM generated from these projects. As the figures in Table 6-4 illustrate, the Harbor Plan supports maintenance and improvement dredging activities and therefore recognizes the need for an environmentally sound, cost-effective UDM disposal alternative.

SECTION 6.0 - ENVIRONMENTAL CONSEQUENCES

Table 6-6: New Bedford Harbor Trustee Council

Proposed Restoration Projects	Proposed Funding Level
<i>Acushnet River Valley Conservation Project</i>	\$964,000
<i>Buzzards Bay Keeper</i>	\$150,000
<i>Community Rowing Boathouse (study and equipment)</i>	\$275,000
<i>Marsh Island Salt Marsh Restoration</i>	\$750,000
<i>Artificial Reef</i>	\$500,000
<i>Educational Exhibit on PCBs impacts</i>	\$150,000
<i>Marine Fish Stock Enhancement</i>	\$1,950,000
<i>Salt Marsh Creation</i>	\$750,000
<i>Nonquitt Salt Marsh Restoration</i>	\$150,000
<i>Popes Beach Land Purchase (North)</i>	\$55,000
<i>Popes Beach Land Purchase (South)</i>	\$145,000
<i>Regional Shellfish Grow-Out Up-Well System</i>	\$500,000
<i>Restoration and Management of Tern Populations</i>	\$1,232,000
<i>Riverside Auto Wrecking Land Acquisition</i>	\$675,000
<i>Upper Harbor CDF Natural Resource Habitat Enhancements</i>	\$25,000
<i>Upper Sconticut Neck Shellfish/Sewer Installation (study and reserve)</i>	\$700,000
<i>Winsegansett Field Station</i>	\$360,000
<i>Total Proposed Funding Level</i>	\$9,331,000

Source: Federal Register Vol. 65., No. 145/July 27, 2000/Notices/pgs. 46146-46152

With the construction of a CAD site, there will be impacts to harvestable or potentially harvestable shellfish (mainly quahog) which may require mitigation. Consultation with DMF has been ongoing and will continue into the next phase of the New Bedford DMMP. Mitigation could take the form of monetary compensation to shell fishermen who harvest these areas.

6.11.1 No Action

If a disposal option for UDM is not identified, dredging projects essential to maintaining the fishing and maritime industries in New Bedford/Fairhaven Harbor could be significantly delayed with negative economic impacts upon the City of New Bedford and Town of Fairhaven. No action would limit the ability to implement the Harbor Plan's vision of maintaining and developing the harbor as an asset for the communities and region and compromise the fishing and maritime industries ability to remain competitive, and in New Bedford/Fairhaven Harbor.

6.12 Risk Effects Synopsis

6.12.1 Ecological Risk Effects Synopsis

The USEPA found that aquatic organisms are at risk due to exposure to waterborne PCBs in New Bedford/Fairhaven Harbor as a result of the Superfund release. The mean PCB concentrations in Zones 3 and 4 exceed the chronic AWQC at the time of the assessment, and the joint probability analysis indicates that there is significant likelihood that chronic effects would be realized in at least some species inhabiting New Bedford Harbor (USEPA 1990).

The risk probabilities for all major taxonomic groups were found to decline moving towards the outer harbor; though, marine fish may still be substantially impacted in Zone 5. PCB levels in gonadal tissues of winter flounder collected by the USEPA from Zone 3 exceed levels shown to result in reproductive impairment and other effects in marine fish. However, in Zone 4, the likelihood that chronic effects would be realized in typical crustaceans and mollusks was predicted to be less than ten percent. Furthermore the study concluded, PCB levels in organisms from lower trophic levels may either induce toxicological effect or impact predator species (USEPA, 1990).

Risk due to exposure to PCBs is also largely dependent on location of the organisms in the harbor, and may be a function of migratory behavior or reproductive habits (USEPA, 1990). Foraging behavior and prey preferences can also influence the degree of exposure encountered by a particular organism. The effects of chemical stress on an ecosystem can potentially affect such interspecific ecological interactions as competition, predation, and disease resistance. These effects can alter a population's birth and death rates resulting in long-term changes in numerical abundance (Ricklefs, 1979).

The risk assessment conducted by USEPA supports the conclusion that aquatic organisms (particularly marine fish) have been at a significant risk due to exposure to PCBs in the harbor. Concentrations of dissolved PCBs in the area of maximum concentration ($> 4,000$ ppm) and in all areas of the Inner Harbor were sufficiently elevated to result in a significant likelihood of chronic effects to indigenous biota. Results of this analysis suggest that although metals such as copper, cadmium and lead may be having some impact on the harbor ecosystem, the effects attributable to these contaminants are overshadowed by the presence of PCBs at much more harmful levels (USEPA, 1990).

Proposed Preferred Alternatives

Based upon the results of the preliminary pollutant transport modeling, the release of PCBs above water quality standards are not expected as a result of DMMP disposal operations. Therefore, the use of either the Channel Inner or Popes Island North sites are not expected to result in any ecological risk beyond that identified by the USEPA and what the harbor has already been exposed. Additionally, the removal and sequestering of harbor-bottom UDM, associated with dredging projects and disposal site footprints and ultimate disposal cell capping should also help to improve the harbor's overall long-term ecological conditions by further isolating sediments with PCBs. Additionally, the use of CAD BMPs and monitoring, will further reduce the potential for negative short- and long-term impacts to ecological health associated with DMMP CAD disposal.

6.12.2 Human Health Effects Synopsis

The assessment conducted by USEPA applied cancer potency factors to determine excess lifetime cancer risks associated with the PCBs historically discharged into New Bedford/Fairhaven Harbor. Using a threshold of a one in a million probability (1×10^{-6}), that is, an individual is not likely to have greater than a one in a million chance of developing cancer over 70 years as a result of Superfund site related exposure, the calculated total carcinogenic risk from PCBs in the areas of Popes Island North and Channel Inner CAD sites was 2.2×10^{-2} . This rate exceeded both the USEPA's thresholds for level of concern (1×10^{-6}) and 1 in 10,000 (1×10^{-4}) for remedial action. As part of the remedy to minimize human health effects resulting from the presence of Superfund material in New Bedford/Fairhaven Harbor, the USEPA established a target cleanup level (TCL) for PCBs of 50 ppm for the area of the Inner Harbor (USEPA, 1990).

Proposed Preferred Alternatives

The range of PCBs mapped by the USEPA for the Channel Inner site fall between less than one ppm to less than 50 ppm, and is not targeted for any remedial activity. A small portion of the Popes Island North site overlaps with an area known to exceed the TCL and has been targeted for remediation (Figure 6-13). Because the Superfund material in the vicinity of the Popes Island North site is expected to be remediated prior to any potential use for DMMP disposal activities, no conflicts are expected. However, CZM will continue its ongoing coordination with USEPA if this portion of the site is to be used for DMMP disposal and dredging operations. Either of the proposed preferred alternative sites would not be expected to involve the dredging or disposal of material above the TCL, and therefore no additional risk to public health associated with the DMMP would be expected.

The use of either the Channel Inner or Popes Island North sites are not expected to result in any human health risk beyond that identified by the USEPA and already posed by the harbor. Additionally, the removal and sequestering of harbor-bottom UDM, associated with dredging projects and disposal site footprints and ultimate disposal cell capping should also help to improve the harbor's overall long-term conditions by further isolating sediments with PCBs from impacting human health. Additionally, the use of CAD BMPs and monitoring, will further reduce the potential for negative short- and long-term impacts to human health associated with DMMP CAD disposal.

6.12.3 No Action

If the preferred aquatic disposal sites are not constructed in New Bedford/Fairhaven Harbor, there would be no additional risk to aquatic organisms or human health above existing conditions due to the exposure of waterborne PCBs in the vicinity of the disposal site.

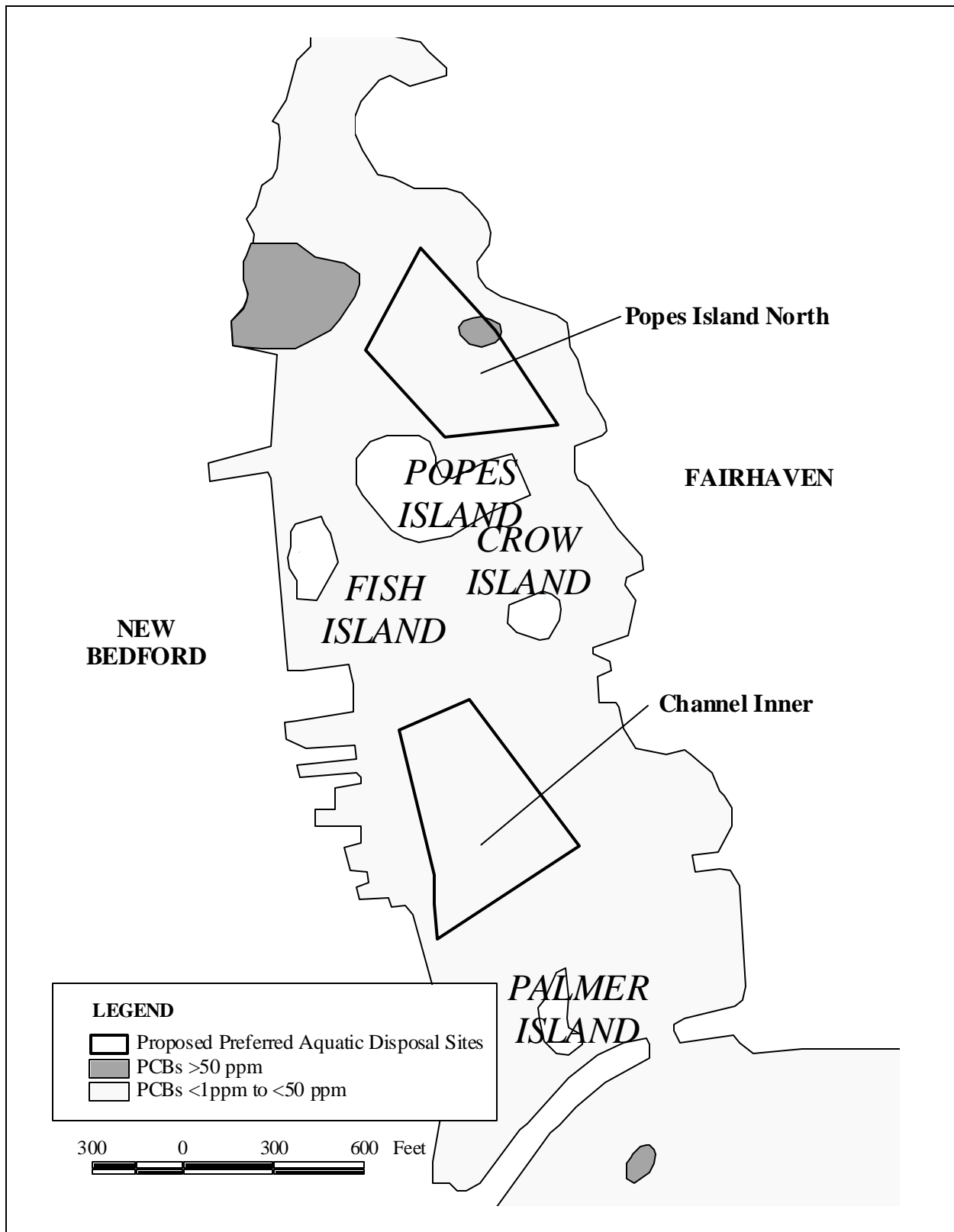


Figure 6-13: PCB Concentrations from Superfund Project (USEPA, 1998)

6.13 *Environmental Justice*

This study recognizes that the proposed preferred aquatic disposal sites are within environmental justice communities. However, the proposed preferred aquatic disposal sites are expected to result in temporary and reversible impacts to the benthos. Since all of New Bedford Harbor is closed to fishing, Channel Inner and Popes Island North sites will not adversely impact subsistence fishers.

The proposed preferred aquatic disposal sites will not negatively impact these environmental justice communities. The economic benefits of the DMMP to New Bedford and Fairhaven will be positive due to the increase in harbor activity. As reflected in the New Bedford/Fairhaven Harbor Plan, the fishing industry and seafood processing/wholesaling, currently account for an estimate \$671 million in sales and 3,700 jobs within the local area (See Table 5-15). An improved coastal environment will generate more revenue and jobs for the community at large. Additionally, the *Harbor Plan* supports maintenance and improvement dredging activities as well as the concept of aquatic disposal of UDM.

6.13.1 *No Action*

If a disposal option for UDM is not identified, dredging projects essential to maintaining the fishing and maritime industries in New Bedford/Fairhaven Harbor could be significantly delayed with negative economic impacts upon the City of New Bedford and Town of Fairhaven. No action would limit the ability to implement the Harbor Plan's vision of maintaining and developing the harbor as an asset for the communities and region and compromise the fishing and maritime industries ability to remain competitive, and in New Bedford/Fairhaven Harbor.